CityFibre

2015 Digital Communications Review

Non-Confidential Version

Response submitted by CityFibre Infrastructure Holdings PLC

8th October 2015

Contents

CityFibre's response to Ofcom's Strategic Review of Digital Communications

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1 Introduction

1.1 About CityFibre

1.1.1 As one of the largest and most innovative investors in the UK's digital infrastructure, we take a deep interest in Ofcom's regulation of the sector. We welcome this strategic review as we believe the UK is now at a critical juncture, where our aging communications networks must be upgraded or replaced with modern digital communications infrastructure that will serve the needs of business and consumers in the future.

1.1.2 CityFibre, the largest independent provider of wholesale open access fibre infrastructure to UK mid-sized cities, enables gigabit connectivity through building, owning, and operating fibre-optic infrastructure that is utilised downstream by CPs and MNOs; providing pure fibre connectivity to businesses, homes and the public sector.

1.1.3 Today, CityFibre operates over 650 route kilometres of local access fibre networks serving over 60 towns and cities with a further 400 kilometres in construction. As a large investor in fibre-optic infrastructure nationwide, our coverage is growing rapidly through a strategy to deploy end-to-end fibre connectivity to all users and applications citywide.

1.1.4 We are rolling out a model of Gigabit Cities; projects are underway in York, Peterborough, Coventry, Aberdeen, Edinburgh, Kirklees and Hull. Our objective is to deliver 100 Gigabit Cities over the coming seven to ten years, and we are implementing plans to rapidly accelerate the speed of deployment.

1.1.5 Our 100 Gigabit Cities plan aims to bring pure open access wholesale fibre infrastructure to 100 towns and cities nationwide, serving an addressable market of circa:

- 6.0m homes
- 600,000 businesses
- 6,000 mobile cell sites
- 16,000 public sector sites

1.1.6 CityFibre's joint venture with Sky and TalkTalk is delivering FTTP networks for residential homes that are independent of BT Openreach. Work is advancing in York with Sky and TalkTalk's Ultra-Fibre-Optic (UFO) services now available to residents offering broadband up to 1Gbit/s. The opportunity exists for UFO type FTTP broadband services to be deployed across all of CityFibre's Gigabit City projects.

1.1.7 CityFibre has signed national frameworks agreements with EE/Three/MBNL and Vodafone to deliver dark fibre connectivity for mobile backhaul and other core infrastructure. This will support innovations in mobile networks to enable higher speed mobile services. The UK first citywide dark fibre network for mobile backhaul is being delivered in Hull.

1.1.8 Further information about CityFibre and our business model is provided the annex sections of of our BCMR submission (attached here in Annex B).

1.2 *The structure of this response*

1.2.1 As a builder of fibre infrastructure, we have focused our response on the topics relating to the physical infrastructure (ducts and fibre cables) that support the UK's digital communications.

1.2.2 In undertaking their strategic review Ofcom's overall objective should be to create a regulatory framework and enabling policies that meet consumer demands and maximise benefits for consumers over the period of this review and beyond.

1.2.3 Ofcom needs to consider the best way to meet those demands in the most effective and efficient way. In this regard, Ofcom appear to face three fundamental questions:

(1) Can the demands best be met by regulated passive and active access to BT's local access infrastructure? Or,

(2) Are they best met through the development of new access networks that compete with BT's current infrastructure? And,

(3) Regardless of the answer to the two questions above, would the market function best and deliver better outcomes for consumers using the current (or modified) approach of functional separation of BT Openreach, or should a part of BT (to be defined) be structurally separated from the rest of BT.

1.2.4 In this response, we initially consider the first two questions and then lastly the third question. But first we look at defining consumer demand to help establish Ofcom's objectives that should be achieved by any changes to regulation.

1.2.5 Our response is not structured around Ofcom's specific questions but is intended to address the following questions that are posed in the DCR discussion document:

Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q11, Q12, Q13, Q14, Q15, Q29, Q21, Q22, Q23, and Q25.

1.2.6 Please note that we use the term 'FTTP' in the document to refer to both fibre to the premise for business as well as fibre to the home for residential use.

1.2.7 CityFibre is a member of the Infrastructure Investors Group (IIG), whose members also include euNetworks, Virgin Media and Zayo. The IIG has also provides a response to the DCR consultation.

2 Executive Summary

2.1 Regulation must support pro-competitive fibre infrastructure investment as the priority

2.1.1 It is universally acknowledged that significant investment is required to deliver modern ultrafast communications networks, and that this investment must be made quickly. It is also universally acknowledged that the way consumers adopt and use digital technologies is evolving rapidly and the pace of change is ever increasing.

2.1.2 CityFibre estimates that circa £15 billion (£15Bn) of investment in fibre infrastructure must be made over the next decade, to meet consumer demand and to ensure the UK retains its position as a leading digital nation.

2.1.3 The UK needs a regulatory environment that will encourage this significant investment and embrace change. It is essential that policies and regulation must be pro-investment and pro-competition at all layers of digital communications; passive infrastructure, active networks and the delivery of services to business and consumers.

2.1.4 There is evidence of increasing levels of investment in end-to-end or open access fibre optic networks by CPs that compete with Openreach. Once considered enduring economic bottlenecks are now opportunities for investment, fuelled by demand for modern broadband networks to support exponential data growth and a new generation of IP enabled services.

2.1.5 At a fundamental level, we believe that such investments must be encouraged and not stifled.

2.1.6 Much of today's regulation entrenches historical economic bottlenecks, through heavy handed regulation derived from market review processes rooted on the assumption that the access network is an incumbent supplied 'natural monopoly'. This approach regulates economic value away from the infrastructure, stifling investment. New regulation that safeguards infrastructure value through a period of significant investment is needed.

2.1.7 CityFibre strongly believes that Openreach is not the only answer, and that continuing to consider BT's access network as a 'natural monopoly' will significantly limit investment, innovation and growth in our digital economy. Structural separation alone will not provide the answer, and could exacerbate the UK problems if it were to move us even closer to an Openreach supplied monopoly infrastructure. This would be a backwards step.

2.1.8 Therefore, it is our belief that Ofcom must adopt an approach to regulation that promotes value and incentivises pro-competitive investments in modern digital infrastructure. We elaborate our augments and evidence in the following sections of this document.

2.2 Delivering quality, choice and value to consumers

2.2.1 To meet consumer interests, Ofcom need to promote quality, choice and value for money. The focus of the DCR should be to ensure that the needs and demands of consumers are met in the most effective and efficient manner.

2.2.2 Consumer use of digital communications is evolving rapidly. The widespread adoption of apps, the cloud and OTT content delivery is both simplifying and enriching an increasing array of digital communications services, both in the home and at work. The boundary between fixed and mobile communications will continue to blur and converge.

2.2.3 New 'OS' driven eco-systems have emerged with companies like Apple, Samsung and Google redefining how we communicate and how we access and use digital services. These trends will accelerate, as will the emergence of connected homes and the Internet of Things (IoT).

2.2.4 By the end of the ten year review period of the DCR, driverless cars, wearable and embedded devices and artificial intelligence will be common place. In fact, with the pace of digital innovation ever increasing, it is difficult to accurately predict what our digital communication environment will look like in 2025, and which companies or brands (many of which may not exist today) will emerge as market leaders.

2.3 Consumer demand is evolving to 'fat-pipes' and 'apps'

2.3.1 However, we do know that processing power and digital storage continues to track Moore's Law, doubling every year. As a result, it is predictable that connectivity speed and bandwidth demand will continue to track Nielsen's Law, increasing by 50% every year. We expect these laws to hold throughout the ten-year period of the DCR.

2.3.2 Taken together with the rapid changes to how citizens and businesses use and interact with digital technologies, we anticipate that consumers will demand simplified 'fat pipe' IP connectivity in both fixed and mobile networks, enabling the flexibility to interact with apps and communications services hosted in the cloud.

2.3.3 Consumers will be attracted to higher bandwidth offers from CPs, and will increasing purchase connectivity independent of services, which will be subject to separate subscriptions and delivered over the top, providing greater control, flexibility and choice to consumers.

2.4 Gigabit speed broadband must be widely available by 2025

2.4.1 It is CityFibre's belief that bandwidth demand will continue exponentially, and that a greater use of the cloud and the growth in IoT will mean that connectivity shifts towards symmetrical connections, where upload speed is as important and download speed.

2.4.2 Applying Nielsen's Law informs us that widespread availability of 1Gbit's broadband should be common place in the UK by 2024. (see figure 1). It is commonly agreed that the preferred infrastructure to delivery symmetrical 1Gbit/s connectivity is FTTP, and Ofcom's own analysis indicates that the UK currently has extremely low FTTP coverage in comparison with international benchmarks (see figure 2).

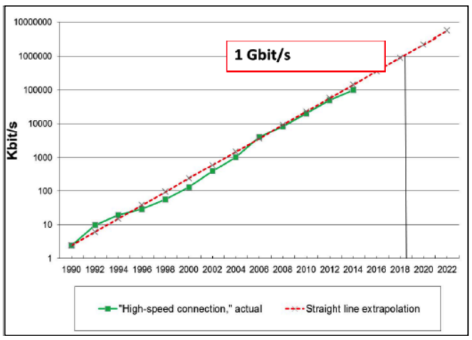

Figure 1 – UK broadband speed follows Nielsen's law
Source: Graham Finnie, Heavy Reading, 2015

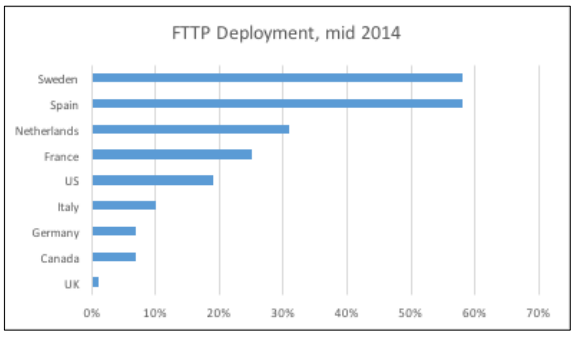

Figure 2 – International FTTP covreage benchmarks
Source: Analysys Mason report for Ofcom, 2015

2.4.3 By 2025, most mobile networks will have deployed 5G wireless technologies supporting mobile data connectivity of >1Gbit/s. The 'fixed' infrastructure of mobile networks, in the core and in the mobile backhaul links to an increasing number of cells, will evolve to very high capacity connections delivered over fibre.

2.4.4 Furthermore, as general availability of 1Gbit/s increases over the 10-year period of the DCR, we believe it is appropriate to consider the appropriate target for broadband connectivity in any form of Universal Service Obligation (USO), and in this regard, it is CityFibre's view that the USO should be set at far greater that the suggested 5Mbit/s (we feel that 30Mbit/s by 2025 would be more appropriate).

2.5 Construction of FTTP fibre infrastructure is critical

2.5.1 Between 2015 and 2020 there is forecasted to be 75% growth in global FTTP connections where as xDSL connections over copper will decline 17% in the same period[1]. As shown in figure 2 above, the UK is well behind international benchmarks, given that current FTTP coverage in the UK is only 1% compared with over 50% in other countries.

2.5.2 Copper based connectivity in the UK should be phased out to the greatest extent possible by 2025, meaning that VDSL should be considered an interim technology and use of G.FAST should be discouraged.

2.5.3 G.FAST requires short copper distances, and is therefore best suited to urban locations. However, commercial viability of FTTP in all urban location indicates that G.FAST is an unnecessary compromise, and whilst we can understand BT's attraction to G.FAST as a quick 'speed fix' in areas of Virgin Media's DOCSIS coverage, we believe this would be inefficient investment as FTTP deployment will still be necessary.

2.5.4 By 2019 66% of global IP traffic will be metro IP traffic (meaning that it will originate and terminate within metro urban locations) and that 62% of all internet traffic will cross content delivery platforms[2]. This indicates a need for fibre rich networks in the UK's towns and cities.

2.5.5 In analysis provide to Ofcom in our BCMR response, CityFibre has demonstrated that our modern FTTP infrastructures are more efficient that current Openreach infrastructure, proving total cost of operating fibre networks is far more efficient that legacy of hybrid technologies.

2.6 International approaches should guide the UK's ambition

2.6.1 For example, at the end of 2014, Sweden had achieved 70% coverage of FTTP with a take up rate of 47%[3].

2.6.2 New Zealand is implementing a programme to deliver 80% coverage of FTTP by 2020. Whilst the approach they are taking may not be appropriate in the UK, the FTTP coverage target sets a bar that the UK should equal or exceed.

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1 Broadbandtrends: Global Fixed Broadband Subscriber Forecast (2015-2020), March 2015

2 Cisco – Visual Networking Index http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

3 http://www.ftthcouncil.eu/documents/Presentations/20150211PressConfWarsaw.pdf

2.6.3 In the US, Google Fiber has stimulated the Gigabit City movement with many CPs now constructing FTTP networks. For example, AT&T, Cox Communications, Google Fiber and CenturyLink all offer symmetrical 1Gbit/s broadband today. Comcast has recently launched its 2Gbit/s residential service in Atlanta and EPB has launched a 10Gbit/s residential service in Chattanooga, both using FTTP technology to homes.

2.6.4 In order to keep up with global norms, Ofcom's approach to future regulation must seek to encourage investments to achieve a high level of FTTP penetration and high capacity metro infrastructure throughout the UK by 2025.

2.6.5 In many international examples, it is challenger CPs (new infrastructure builders) that ere the catalyst for change and development. Stokab (Sweden), ReggeFiber & EuroFiber (Netherlands), Google Fiber (US) and examples. We believe this will be true in the UK also.

2.7 The need for speed

2.7.1 Having established that competitive supply of FTTP is vital for the UK to be a leading digital nation, we believe that Ofcom must provide a regulatory environment that promotes a quick and efficient nationwide rollout.

2.7.2 Scale FTTP deployment must commence at the beginning of 2016 in order to achieve 80% FTTP coverage by end of 2024. The impact of delay is considerable, as illustrated in figure 5 below. Based on CityFibre's modelling, a two-year delay (shown by the yellow line) is likely to result in coverage only reaching 40% by 2024, which is half of our proposed target.

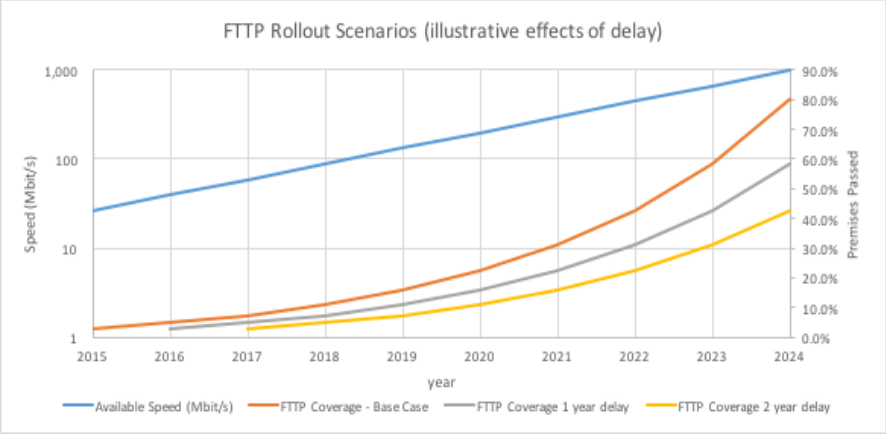


Figure 5 – Delay effects on coverage of FTTP rollout

Source: CityFibre

2.7.3 Therefore, Ofcom's DCR process and any future approach to regulation must seek to avoid delays to investments, as delay would have adverse impact to coverage levels. CPs will need a stable regulatory environment that gives confidence of predictable returns to fibre infrastructure investors.

2.7.4 CityFibre view the following issues as current regulatory risks that threaten investment certainty and would cause a significant delay of FTTP build of >2 years:

- The implementation of the BCMR passive remedies as proposed by Ofcom resulting in a devaluing of passive infrastructure with adverse impacts to investment incentives.
- Potential structural separation of Openreach if this led to lengthy delays to investment due to the potential complexity of defining and implementing the chosen solution, and the uncertainty created for investors and CPs.

2.7.5 The UK is witnessing a wave of investments from new infrastructure based CPs, and it is our view that such investments must be encouraged and not stifled. There is significant appetite, and plans underway, to accelerate these investments subject to a supportive regulatory environment.

2.8 Pro-competitive investment will deliver greatest coverage of FTTP & ultrafast

2.8.1 The deployment of FTTP is occurring in the UK alongside and in competition with copper and cable networks, for example, through deployments by alternative infrastructure providers such as CityFibre and Gigaclear.

2.8.2 CityFibre estimates circa £11.5Bn of FTTP investment will achieve 80% coverage of UK premises by 2025. Furthermore, we believe this can be delivered through private sector investment if a stable and supportive regulatory environment prevails.

2.8.3 With further expected investment in cable, such as Virgin Media announced plans for Project Lightning we estimate that investment in FTTP and other competing ultrafast networks could rise to circa £15Bn by 2025[4].

2.8.4 The following figure 3 and figure 4 illustrates the potential cumulative investment achievable by 2024, to secure general availability of 1Gbit/s broadband to 80% of premises. This coincides with the predicted demand in line with Nielsen's law and international norms.

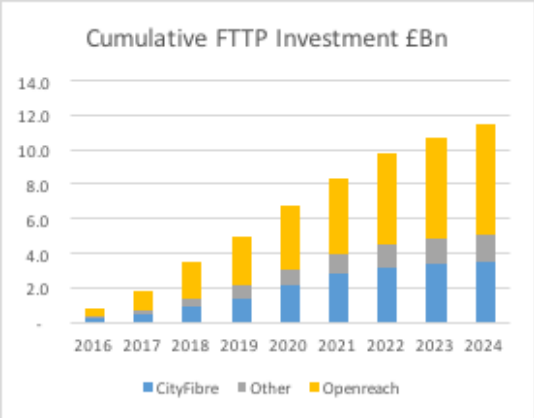


Figure 3 – illustrative FTTP investment (excluding VM cable)
Source: CityFibre estimates

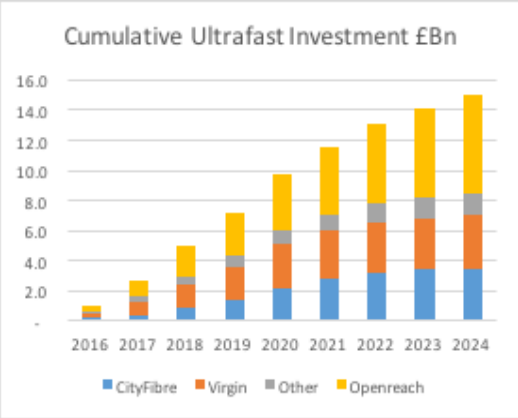


Figure 4 – illustrative Ultrafast investment (FTTP+VM cable)
Source: CityFibre estimates

4 Based on CityFibre's estimate of £11.5Bn plus VM's announced plans for £3bn investment by 2020 with an additional estimated £500m investment by VM from 2021-2025.

2.8.5 The above demonstrates that in terms of infrastructure, the UK market is becoming increasingly competitive with a significant proportion of investment likely to be deployed by alternative providers.

2.8.6 By supporting a pro-competitive approach to fibre investment we estimated that:

- Circa 45% of the required investment in FTTP & Ultrafast investment may come from Openreach, and
- Circa 55% of the required investment may come from infrastructure competitors to Openreach.
- Private investment should achieve FTTP deployments to cover 20 million premises by 2025[5].
- Virgin Media's plans will enable competition from cable in circa 17 million premises.

2.8.7 Furthermore, fibre infrastructure supporting 5G mobile backhaul and other core infrastructure will be needed throughout the UK. Modern high capacity fibre infrastructure, such as that provided in CityFibre's Gigabit City model, will deliver fit-for-purpose infrastructure that will support for a wide range data hungry technologies and services.

2.8.8 Investments in passive infrastructure over the next decade will have a lifespan of many years. New infrastructure will need to support data growth and evolution of digital communications for decades to come, and it this respect we are building infrastructure for to support data growth and applications that are unknown today. Therefore, the deployment of FTTP networks must be designed to be future-proof to the highest extend possible, by having very high capacity modern duct architectures that will support a high volume of point to point fibres, or architectures upgradeable to point to point fibre.

2.9 An Openreach 'monopoly' must be avoided, and a level playing field created

2.9.1 New end-to-end or open access fibre optic networks are being deployed by CPs that compete with Openreach. What in the past was considered an enduring bottleneck is now an opportunity for investment, with most of the UK's geographic markets (cities, towns and villages) now contestable. The majority of the UK's access network is no longer a 'natural monopoly'.

2.9.2 In the recent past Ofcom have adopted the presumption that investment in alternative infrastructure is not feasible, unless proven so. Going forward, this presumption must be reversed; CityFibre believes that Ofcom must recognise evidence of contestability (and future contestability) to ensure that infrastructure investment is encouraged.

2.9.3 Ofcom must now accept a position that Openreach is not a 'natural monopoly' and recognise that BT is no longer the only answer to infrastructure supply. Future regulation should acknowledge and promote infrastructure competition and investments by other CPs.

2.9.4 Regulation that is based on the premise of Openreach being a monopoly supplier must be halted. For example, in the 2015 BCMR, Ofcom has proposed to set prices for regulated

5 Assuming that there is limited duplication of FTTP networks in the same geographic areas through this rollout period,

access to BT's dark fibre at levels that are unachievable in a competitive market. If implemented these prices would risk foreclosure to investment and competition. This would be an irreversible action that would entrench Openreach as a monopoly infrastructure supplier, with adverse impacts on investment and longer term consumer outcomes. Therefore, Ofcom should not implement its proposals for regulated dark fibre access as presented in the BCMR consultation.

2.9.5 A fairer market supporting pro-competitive fibre infrastructure investment is now needed, and this should be the basis for Ofcom's future regulation.

2.9.6 If Openreach were to be separated from BT, it would be vital that such separation should not be justified on the basis of Openreach being a monopoly supplier of the UK digital infrastructure, as this would deny competition, harm investment and ultimately reduce consumer benefits substantially. Therefore, any consideration about the future structure of BT should not compromise the creation an effective competitive infrastructure market.

2.10 The appropriate model for competition

2.10.1 The promotion of effective and sustainable competition is the single most important and fundamental principle Ofcom should apply. It is our strongly held view that competition throughout the supply chain (passive, active and services) will deliver vastly superior results when compared to the option of a market that is primarily based on regulated access to BT's infrastructure.

2.10.2 The approach to competition may be considered in relation to the commonly used three-layer model.[6] Figure 6 below shows four models of competition.

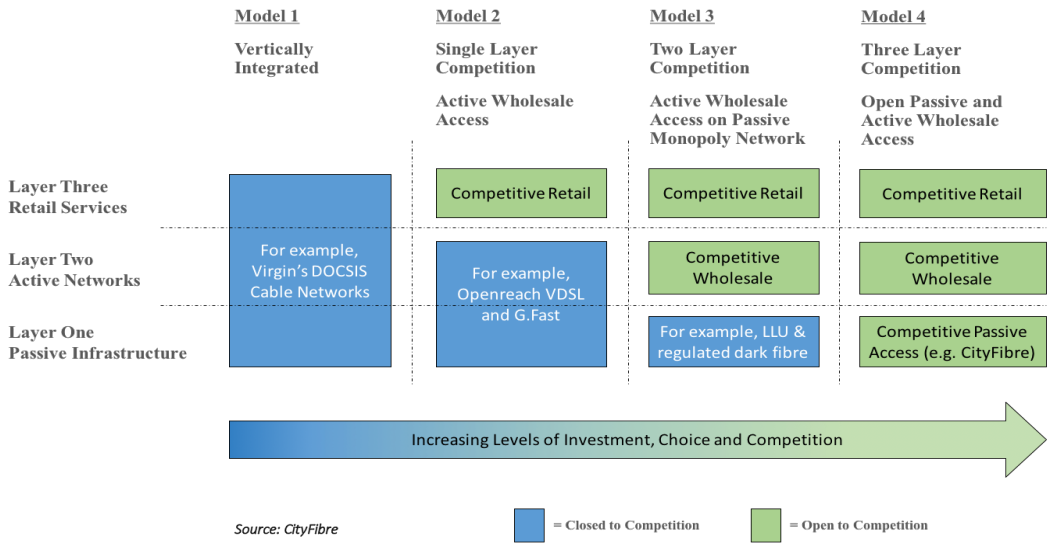


Figure 6 – Competition models

Source: CityFibre

6 For example, as discussed in the European Commission Guide to High Speed Broadband Investment, Release 1.1, 22 October 2014

2.10.3 Currently, the UK has a number of the above models in operation, as illustrated by the examples in figure 6. Ofcom must consider which model (or combination of models) will maximise quality, choice and value for consumers, and will promote FTTP investments.

2.10.4 Broadband rollouts based on current incumbent plans from Virgin Media (Model 1) and BT Openreach (Model 2) will not deliver best outcomes, as it limits competition within the supply chain and relies on investment from two incumbent providers.

2.10.5 Model 3 is likely to assume a BT Openreach monopoly infrastructure, so should not be considered for the reasons stated above (although we note that this is the direction that Ofcom is, perhaps inadvertently, proposing in the current BCMR).

2.10.6 CityFibre believes that Model 4, where investment and competition is promoted at all three layers, will deliver best consumer outcomes in terms of quality, choice and value. Therefore, regulation must consider how to promote a model of effective competition at layer-1 passive infrastructure and also at layer-2 active wholesale; acknowledging that there maybe limited ability to intervene in the structure of Virgin Media's closed vertically integrated model.

2.10.7 Therefore, a regulatory framework that promotes pro-competitive investment in open access layer-1 passive infrastructure (in particular with regard to the wholesale availability of dark fibre from CPs other than BT) will be a catalyst to evolve towards an effective three-layer competition model. This means ensuring that investments from CityFibre (and other passive infrastructure builders) should be encouraged to the highest extent possible.

2.10.8 In international examples[7] where open access passive FTTP networks are deployed in competition to incumbent infrastructure, a vibrant competitive market at layer 2 active wholesale is established promoting further innovation and choice of retail services.

2.10.9 In order for competition to be enabled in all layers, Ofcom should ensure that the strategy developed allows for leaving sufficient economic space between the prices of products in different layers, as illustrated in figure 7 below.

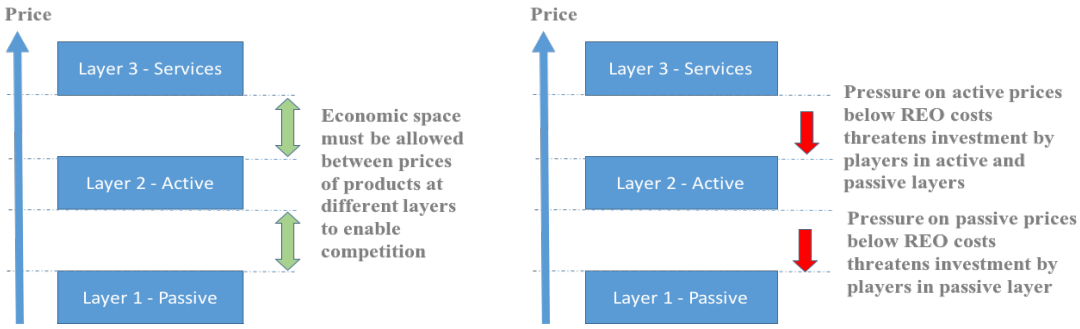


Figure 7 – Economic space in the three-layer competition model

Source: CityFibre

2.10.10 Decisions by Ofcom to set regulated prices at a level that could not be achieved in a competitive market, i.e. below the costs of a Reasonable Efficient Operator (REO), are a

7 For example, as deployed in Sweden and the Netherlands.

direct disincentive to competition. It is CityFibre's position that Ofcom would be in breach of its duties were it to define efficient investment at a level that could not be achieved in a competitive market.

2.10.11 Therefore, Ofcom's approach should not be to regulate wholesale pricing based on BT's dominant scale economies, as to do so would deny investment and competition. In order to preserve economic space in the three-layer model, Ofcom should consider (at least through the decade period of significant infrastructure build) establishing regulated price floors based on the costs of a Reasonable Efficient Operator.

2.11 The 'value' in infrastructure must be retained

2.11.1 Infrastructure investors, whether in Openreach's rollout, CityFibre's or other CP's rollouts, will seek appropriate and predictable returns on investments. They will need to see that the layer 1 passive infrastructure is a valued yield generating resource.

2.11.2 Therefore, regulation that undermines value of passive infrastructure must be avoided.

2.11.3 It is widely accepted that BT's current infrastructure is not fit-for-purpose and must be upgraded to support a significant increase in fibre capacity, which will require new physical construction of duct and fibre at large expense. Therefore, it is perverse that current regulation strives to regulate value out of the infrastructure by imposing significant reductions to BT's access prices. It is now time for this pattern of regulatory behaviour to cease.

2.11.4 Regulated prices on BT's infrastructure sets a celling on the wholesale prices of alternative infrastructure, meaning that how Ofcom set prices on BT effects the prices obtainable by all other competing wholesale CPs.

2.11.5 Ofcom has a choice of either allowing BT to continue to make claimed 'excess profits', or alternatively, regulate value out of infrastructure by imposing significant reductions to BT wholesale prices. If £15Bn of investment is needed to bring the UK up to global norms in infrastructure terms, then surely the answer is clear. Infrastructure must retain its value and investment must be attracted, as a matter of priority.

2.11.6 This does not imply that wholesale access prices should increase, rather that there is no justification to reduce them. As we have stated in our response to the BCMR, Ofcom should consider a CPI-CPI safeguard cap on regulated access prices (a slight reduction in real terms), but it should not impose further price reduction at a time when significant investment must be made.

2.11.7 Openreach will need to invest in fibre rollout in a pro-competitive market where, overtime, its share of the infrastructure market will decline through the effects of healthy competition. Therefore, the period whereby BT may enjoy 'excess profits' is time bound and will come to an end once layer 1 competition is established. Ofcom should consider provisions that ensure 'excess profit' is directed to FTTP rollout, and maybe also delivering a meaningful USO for broadband.

2.11.8 We outline options for dealing with so called 'excess profits' in section 5.5 of this response.

2.12 *End-to-end competition and lighter touch regulation should be the goal*

2.12.1 In relation to the DCR, it is important to consider the form of regulation that we should be striving to achieve by 2025, and what is the best approach to move towards that goal.

2.12.2 We agree with Ofcom's opinion that *"the best mechanism for delivering choice, quality and affordable prices is a healthy competitive market".* Furthermore, we agree with Ofcom's view that *"regulation works best when it is targeted where its needed, and removed where it is not"*[8]*.* For this reason, CityFibre believes that Ofcom's outlined option in the DCR for *"Substantial deregulation and greater reliance on end-to-end competition"*[9] should be the longer-term objective. The broader questions are how to get to this outcome efficiently and in what timeframe?

2.12.3 If the opportunity for greater deregulation is only possible once end-to-end competition is realised, it is clear that the regulatory focus must be on achieving pro-competitive infrastructure investment. In this regard, we believe that a strengthened or modified form of regulation to support investment is needed initially, for example to enable the introduction of price floors and the adoption of REO cost benchmarks.

2.12.4 Furthermore, in moving toward the three-layer competition model, it would be beneficial for the layer-2 and layer-3 functions of BT's current businesses to operate with a greater degree of independence of its own infrastructure. This would allow for BT's retail services to be provided over the passive infrastructure of other CPs – for example, CityFibre builds open access networks that are available for use by BT. This consideration should also extend to its wholesale operation, especially to its EMP wholesale order management systems. We believe this could be achieved either through a strengthened model of functional separation of through structural separation.

2.13 *The pros and cons of structural separation in achieving strategic aims*

2.13.1 If a greater level of end-to-end completion coupled with a light touch approach to regulation is the goal over time, Ofcom should consider whether structural separation of BT can help achieve this more effectively than the the current (or strengthened) model for functional separation.

2.13.2 As CityFibre promotes open access throughout the three-layer competition model, we are not averse to Openreach being separated, so long as end-to-end competition remains the goal. However, we do not believe that separation itself should be an objective.

2.13.3 We note Ofcom's view in the DCR that a structurally separated Openreach *"would also require ongoing regulation to guard against excess returns by the structurally separated upstream 'monopolist'"*. As stated before, we are opposed to the creation of an Openreach infrastructure monopoly, and strongly oppose regulatory outcomes that entrench a monopoly supply of Openreach infrastructure (such as that proposed in the current BCMR).

8 DCR s. 1.12

9 DCR s. 1.37

2.13.4 Considering the current level of fibre investment by other CPs, moves to regulate towards an Openreach infrastructure monopoly would be anti-competitive and a breach of Ofcom's duties.

2.13.5 Putting aside the debate on forced structural separation, in an environment where significant FTTP investment is deployed by competitors to BT Openreach, it is our view that, over time, BT may become commercially incentivised to restructure its business into two – either layers 1 and 2 together with layer 3 separate, or layer 1 separate and layers 2 and 3 together.

2.13.6 Therefore, imposing separation should only be considered if it accelerates pro-competitive investment in FTTP infrastructure in a timely manner. In this regard, we believe there are risks that Ofcom must take into consideration:

- Imposing structural separation on BT is likely to be a long contentious process. During this process, the market would suffer a period of considerable uncertainty.
- There are no firm proposals for how BT would be structurally separated (there are many options on where to draw the boundary lines) and how the structurally separated unit would be regulated (depending on the which option is chosen).
- Would separation just apply to Openreach, or should Virgin Media be considered in any restructuring of infrastructure from services?
- Uncertainty would cause delays to investments in fibre infrastructure by both BT and its competitors. How would these risks to investment and timely rollout of FTTP be mitigated?

2.13.7 The adverse impact to delays to the investment in FTTP rollout are illustrated in figure 5 above.

2.13.8 Furthermore, implementing regulation that reduces wholesale access pricing thereby devaluing the infrastructure (for example as proposed in the 2015 BCMR), carries the substantial risk of making any future separated entity unattractive for investment and potentially non-investable.

2.13.9 Therefore, CityFibre believes that the primary objective of Ofcom's review should be to establish a regulatory environment that ensures pro-competitive investments in FTTP deployments are accelerated from early 2016. Only when significant FTTP infrastructure build is underway should structural separation be considered.

2.14 The BCMR is not aligned to DCR objectives

2.14.1 Many of the problems with Ofcom's current approach are encapsulated in its proposals in the BCMR. Here, Ofcom propose to impose a 40% reduction by 2019 to Ethernet business connectivity and to introduce mandated dark fibre at pricing that is up to 80% less than the current supply of dark fibre in the competitive market. This results in a substantial 'devaluing' of infrastructure.

2.14.2 Furthermore, Ofcom have chosen to ignore real world investment in FTTP network by alternative providers, and have mistakenly concluded that infrastructure competition is an unlikely prospect. In fact, there is significant investment in new FTTP networks occurring

throughout the UK and this trend is accelerating, resulting in meaningful prospective end-to-end competition.

2.14.3 Ofcom's arbitrary decision to redefine a competitive market as BT + 5 OCPs within 100m (previously BT + 2 OCPs within 200 metres) will entrench enduring bottlenecks and stifle competitive investment. Such practises could be considered to be anti-competitive and serve only in the interests of the incumbent, by prioritising monopoly supply over viable end-to-end-competition.

2.14.4 However, Ofcom now have the opportunity through the DCR process to reassess their approach. Providing that the proposed BCMR active and passive remedies are not implemented, Ofcom will be starting the period post the DCR with a market where investment is actively pursued by a number of competing providers. This should be the ideal position for a regulator with a mandate to promote effective and efficient competition at all levels in the market.

3 Defining Ofcom's strategic objectives

3.1 Introduction

3.1.1 To meet consumer interests, Ofcom needs to promote quality, choice and value for money. The focus of the DCR should be to ensure that the needs and demands of consumers are met over the long term in the most effective and efficient manner.

3.1.2 Ofcom need to consider the delivery of these three components (quality, choice and value) and any potential trade-offs between them.

(4) Quality can manifest itself in two main categories – the type of products you can buy (e.g. what speeds or capacity are available), and the quality of service performance of the products (install performance, reliability, fix times, etc.);

(5) Choice can manifest itself in two main groups – choice of services available, and choice of providers;

(6) Value is measured by overall benefits delivered to the consumer for a given price.

We address each of these below.

3.1.3 In forecasting consumer demand for 2025/26, we believe it is useful to consider both business and residential consumer segments.

3.2 Quality – Connection speeds

Residential consumer demand for 2025/26

3.2.1 Although there are many different forecasts for the required broadband connection speed by 2025, it is accepted that bandwidth demand is will increase significantly, and it is clear that connection speeds will be in excess of 100Mbt/s and likely to be >500Mbt/s if not 1Gbit/s by 2025.

3.2.2 Ofcom include forecasts of broadband speed requirements in section 6 of the DCR Discussion document. Work undertaken by the Broadband Stakeholder Group (BSG) suggests that in 2023 a heavy use household of 4 persons could function on a minimum of a 30Gbit/s connection[10]. CityFibre does not recognise this as representing the demand that Ofcom's strategy should seek to deliver.

3.2.3 Using the BSG demand forecast as the goal for Ofcom to achieve would condemn the UK to the status of a 2nd or perhaps even 3rd tier country in terms of supporting the digital economy. Residential users today are purchasing BT's VDSL services at 38Mbt/s and 76Mbit/s and Virgin Media offer 200Mbit/s services. In a decade from now, it is inconceivable that demand will be supported by the forms of (arguably inadequate) connectivity available today.

3.2.4 In our eyes, the BSG forecast has little or no credibility and should not be used to set Ofcom's objectives. This view is reinforced by the quote below from Forbes:

10 DCR s. 6.16

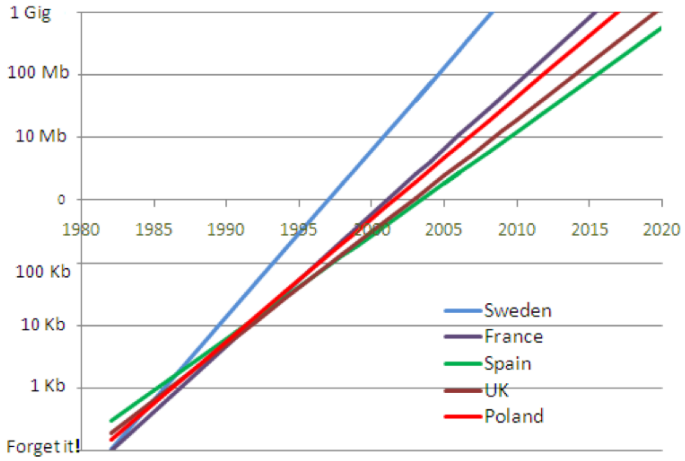
"In 2019, the global fixed broadband speeds will hit 43 Mbps — which is up from 20 Mbps in 2014. Four years from now, Japan and South Korea will hit average speeds of about 100 Mbps. These faster speeds will be useful for streaming video content. In 2019, nearly one million minutes of video content will cross the network every second. And consumer Internet video traffic will be 80% of all consumer Internet traffic in four years[11]"

3.2.5 As a leading world economy, the UK should be substantially ahead of the global broadband speed. Why the UK should 'make do' with 30Mbit/s speed in 2023 when the global speed will be at 43Mbit/s in 2019, is not comprehensible.

3.2.6 Further, Cisco's Visual Networking Index forecasts that internet peak hour traffic will increase by nearly a factor of three between 2014 and 2019.

"Busy-hour Internet traffic is growing more rapidly than average Internet traffic. Busy-hour (or the busiest 60-minute period in a day) Internet traffic increased 34 percent in 2014, compared with 26 percent growth in average traffic. Busy-hour Internet traffic will increase by a factor of 3.4 between 2014 and 2019, while average Internet traffic will increase 2.8-fold. Busy-hour Internet traffic will reach 1.7 petabits per second (Pbps) by 2019"

3.2.7 If one were to apply Nielsen's Law, it suggests that common supply of 1Gbit/s connection speeds would occur around year 2019. See the graph below[12].



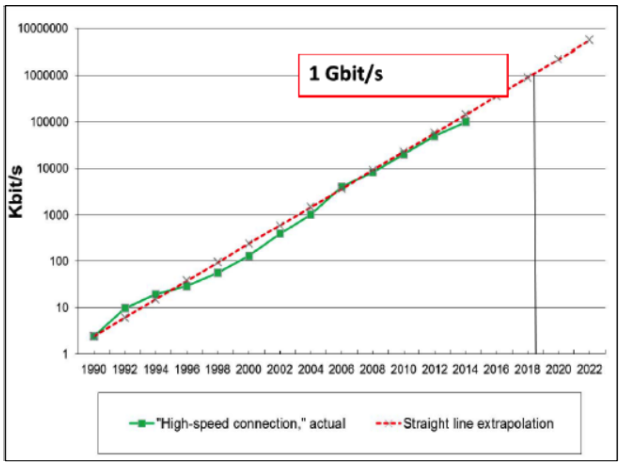
3.2.8 We note that at the end of 2014, Sweden have over 70% coverage of FTTP capable of >1Gbit/s, with a 47% take up rate.

3.2.9 The graph overleaf shows that a simple straight line extrapolation of growth of general internet speed available in the UK since 1990, proving Nielsen's Law. This results in a bandwidth requirement for residential consumers of 1Gbit/s around year 2024[13].

11 http://www.forbes.com/sites/amitchowdhry/2015/06/02/global-fixed-broadband-speeds-to-hit-43-mbps-in-2019-says-report/

12 Ventura Team study for FTTH Council Europe.

13 Graham Finnie, Heavy Reading – Gigabit Europe presentation September 2015.



3.2.10 Although there is uncertainty about what speeds will be required by residential consumers of internet services towards 2025, it seems clear that speeds in excess of 500Mbit/s are likely to be demanded at or before the end of the 10-year period for this strategy review.

3.2.11 In New Zealand, the Government has set a target of 75% coverage of ultrafast FTTP by 2019, with a proposed extension to reach 80%[14]; construction is underway. Currently broadband speeds of 100Mbit/s are available, with the ability to easily upgrade to >1Gbit/s.

3.2.12 Internationally, the general availability of gigabit speed residential broadband connections is here today. For example, in the US market there are many competing CPs providing 1Gbit/s broadband including AT&T, Cox Communications, Google Fiber and CenturyLink. Comcast has recently launched its 2Gbit/s residential service in Atlanta EPB has launched a 10Gbit/s residential service in Chattanooga, both using FTTP technology to homes.

3.2.13 Deployment of FTTP is now underway or advanced in many EU countries enabling increasing current availability of 1Gbit/s broadband.

3.2.14 Upload speed must be considered. VDSL and cable networks in the UK are asymmetric with inferior upload capability when compared to headline download speeds. Currently upload speeds are often ignored in the analysis of broadband demand – this is a mistake.

3.2.15 The use of cloud storage and two-way HD video communications is now common place. For example, the iPhone 6s has 4K ultra-HD video recording with content storage in iCloud. The same Apple devices provide widespread use of two-way HD video-conferencing via its popular FaceTime app, and user adoption of similar services will increase across fixed and mobile platforms, increasing upload bandwidth requirements.

3.2.16 Cisco forecasts 50 billion connections through the Internet of Things (IoT) globally by 2020[15]. It is expected that the connections will need more symmetrical connectivity that currently applied to conventional residential internet access services.

14 http://www.mbie.govt.nz/info-services/sectors-industries/technology-communications/fast-broadband/the-ufb-initiative-and-getting-connected

15 CISCO reference: http://www.cisco.com/web/solutions/trends/iot/portfolio.html

3.2.17 Referring to the US example, the 1Gbit/s and 2Gbit/s broadband services mentioned above are all symmetrical, meaning that provide the same speed connectivity for both upload and download.

3.2.18 Ofcom should therefore ensure that their strategy enables competitive supply of ultrafast networks that encourages widespread availability of broadband at symmetrical speeds of 1Gbit/s no later than the end of the 10-year period, ideally sooner. Policy and regulation should ensure that investments in digital networks deliver infrastructure that is future-proofed to the highest extent possible.

Business demand for 2025/26

3.2.19 In their ongoing Business Connectivity Market Review (BCMR) Ofcom include limited forecasts of growth rates for high speed connections. These include forecast that 1Gbit/s, 10Gbit/s, and >10Gbit/s services will grow by 24% 35% and 15% CAGR between 2016 and 2018[16].

3.2.20 In addition, we note that Cisco's Visual Networking Index forecasts that:

> ***"Business IP traffic will grow at a CAGR of 20 percent from 2014 to 2019****. Increased adoption of advanced video communications in the enterprise segment will cause business IP traffic to grow by a factor of two between 2014 and 2019." And "****Business Internet traffic will grow at a faster pace than IP WAN****. IP WAN will grow at a CAGR of 23 percent, compared with a CAGR of 20 percent for fixed business Internet and 51 percent for mobile business Internet."*

3.2.21 It seems that there is agreement that the need for >1Gbit/s by businesses will show very high growth. CityFibre sees no reason why that growth pattern would not continue throughout the period covered by the DCR. Indeed, CityFibre is seeing significant demand from business and public sector users of >1 Gbit/s today.

3.2.22 A segment of larger enterprises and public sector organisations (heath, education etc.) will continue to procure bespoke networks. However, as bandwidth requirements rise we expect to see an increasing demand for bespoke dark fibre networks (or high capacity ring networks).

3.2.23 Furthermore, data centres, MNOs and CPs are demanding backhaul and core infrastructure in urban metro networks at very high speeds (10Gbit/s or greater).

3.2.24 Cisco predicts that by 2019 metro IP traffic will increase to 66% of total global IP traffic, and that 62% of all internet traffic will cross content delivery platforms[17]. This indicates that local access infrastructure in urban metro markets must support significant growth in bandwidth.

3.2.25 By 2025, mobile connectivity will have evolved to 5G. This places a need for a far greater number of mobile cells in urban areas capable of supporting very high data capacity. MNOs will seek new infrastructure models for C-RAN and other innovations based on >10Gbit/s connectivity or dark fibre.

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16 BCMR Annexes table A13.2.

17 Cisco – Visual Networking Index http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

3.2.26 Therefore, in addition to general availability of 1 Gbit/s symmetrical connectivity for residential users, Ofcom's strategy must ensure investment and delivery of very high capacity modern fibre infrastructures in urban metro environments to secure the appropriate connectivity for businesses, public services, data centres, MNO and other carriers.

3.3 Quality – Service performance

3.3.1 Although we expect that there will be a sustained difference in quality of service requirements between residential and business customers, the dependency on connectivity will increase substantially for all users. Connected homes may well be common practice by 2025 and the care sector, for example, may be heavily reliant on high quality broadband connectivity to interact with and monitor vulnerable individuals in their homes.

3.3.2 Bandwidth requirements are rapidly increasing for businesses through adoption and reliance on the cloud for remote hosting of data and IT applications. This creates a need to transfer large volumes of data in real time in an 'always on' environment.

3.3.3 With this increased dependency on connectivity comes a vulnerability to network downtime or performance problems. Connection problems (contention and bottlenecks) and fault rates for services provided fully or partially over copper networks are higher than for those provided over all-fibre networks. As high capacity metro networks and FTTP are deployed, consumers will benefit from the higher levels of service performance that are associated with end-to-end fibre services.

3.3.4 Ofcom have identified in the DCR and in the BCMR significant Quality of Service (QoS) issues in BT's network and the performance of Openreach. The strategy for the next 10 years must include, as a priority, how to maximise the reliability and performance of digital connectivity in the UK, otherwise this could severely damage the UK's competitiveness.

3.3.5 The significant increase in metro IP traffic forecast by Cisco means that there is an increasing need for carrier grade fibre networks in urban local access infrastructure. This requires priority investment is high capacity FTTP infrastructure to overcome contention and bottlenecks in data transmission associate with copper and cable networks.

3.3.6 We therefore believe that Ofcom should include a consideration of the need for improved quality of service guarantees to both private users as well as businesses and carriers, and to understand that migrating away from copper technologies such as VDSL and G.FAST is a priority.

3.4 Choice - Selection of services available

Residential services

3.4.1 Over the Top (OTT) delivery of content, the increasing use of 'apps' and the growth of the Internet of Things (IoT) will dramatically increase the number of services and the way that consumers purchase and interact with those services.

3.4.2 Increasingly, the broadband connection will become a 'bit pipe' that carries IP traffic from a multitude of different services simultaneously, from multiple users and an increasing number of connected devices.

3.4.3 Therefore, it can be expected that buying decisions for consumer broadband (both fixed and mobile) will evolve towards 'fat pipe' connectivity, with consumers seeking fast reliable IP connection that will support the various applications and content provided by different service providers under separate subscriptions.

3.4.4 Bundling of services may evolve to providers of 'operating systems' that are separate from traditional supply of communications services and networks. Google, Amazon, Apple and Samsung are aggressively competing in this space, creating new eco-systems of connected devices, content and apps integrated across fixed and mobile connectivity, utilising the IP connectivity provided by CPs.

3.4.5 Therefore, in terms of connectivity, we believe consumer demand for broadband will evolve towards fat-pipes, with consumers attracted to higher bandwidth offers from CPs. It is therefore important that Ofcom's strategy supports the widespread availability of ultrafast connection speeds taking into account the separation from the supply of connectivity from the consumption of services.

Business and enterprise services

3.4.6 The service availability trends for residential consumers detailed above are also relevant to business users. By 2025, we expect the majority of corporate and public sector IT applications will be remotely hosted in the cloud, with a significant increase in smaller localised data centres.

3.4.7 Hosted business applications will be available to users via multiple devices including mobiles and tablets, enabled by simplified IP connectivity. This enables a far greater flexibility of working location and a blurring between residential and business connectivity; more workers will have technologies to access business applications whilst working from home or on the move.

3.4.8 More importantly, the potential for innovation in the business and enterprise sector is significant, fuelled by the rapid adoption of digital technologies. Therefore, the availability of reliable ultrafast networks for business, scientific and the public sector users (e.g schools, universities and hospitals) is essential if we are to unleash the wave of new innovation which is possible with gigabit connectivity. For example, EPB launch of 10Gbit/s FTTP to residents and small business is Chattanooga is partly influenced by a desire to make Chattanooga a hub for digital innovation.

3.4.9 For larger enterprises and public sector organisation, connectivity services will still differentiate on a range of parameters including speed, QoS, redundancy, and a number of other technical parameters such as security.

3.4.10 When considering the ability of digital communications to maximise service differentiation and fuel innovation, we believe it is vital that Ofcom ensure a regulatory environment that support investment in the enabling infrastructure, which requires very high capacity fibre core fibre infrastructure and FTTP to premises.

3.5 Choice – Presence of competing providers

3.5.1 The presence of competing providers is widely accepted to increase the level of competition in terms of selection of services, quality of services and the pricing and value for money of the services available.

3.5.2 Ensuring that the strategy for the next 10 years for UK digital communications will support competing providers is therefore critical. From a consumer's perspective however, choice will evolve over the next 10 years.

Residential service providers

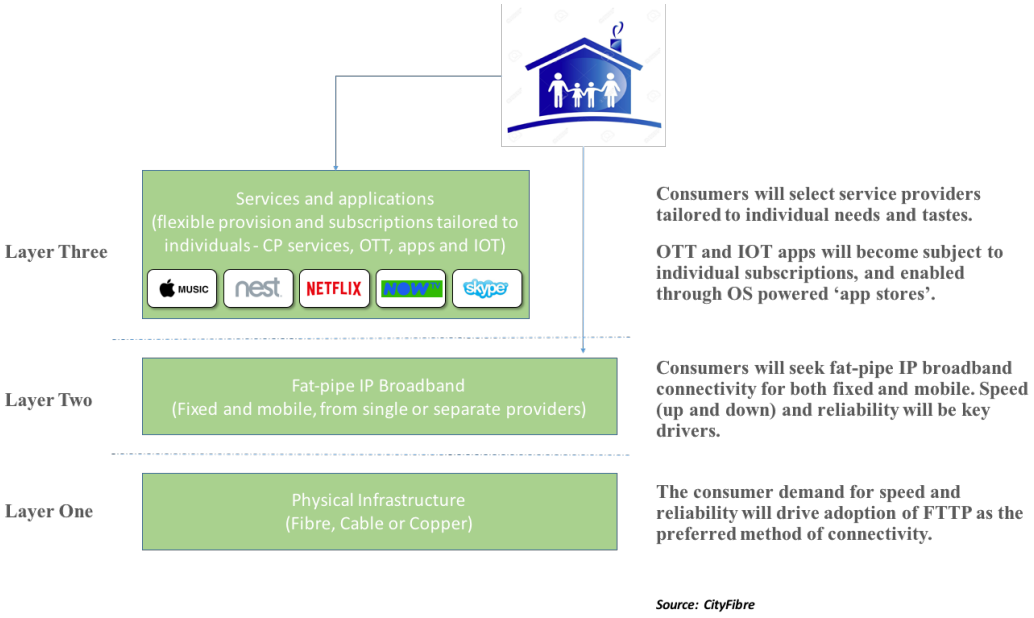
3.5.3 Presently in the UK, consumer choice is seen as the choice of providers who 'assemble' the full service for the consumer, and the current major CP's (notably Sky, TalkTalk, BT & Virgin) seek to bundle their service offerings to lock in subscribers. We note that Ofcom is concerned about the increasing dominance of these providers and rising consumer prices resulting from consistent hikes in line rental charges.

3.5.4 However, as described above, the increasing trend towards the cloud, OTT applications and OS driven app stores will challenge the current model of service bundling.

3.5.5 In some parts of the world, led by Sweden, there is a move to increase the level of choice offered to the consumer. This manifests itself, for example, in clear separation between the physical networks, the broadband communications operators, and retail service providers; enabling choice at all three layers of the communications model (passive, active and services).

3.5.6 The Swedish model is based on the full open access principle and takes it a level further than what is presently available in the UK. When customers in Sweden want a broadband connection, they first purchase a physical connection and separately assemble their portfolio of services, including their choice of IP carrier they wish to use and the applications they wish to subscribe to. This is controlled through simple app store style online portals. Therefore, to change the IP carrier or the portfolio of services, a customer simply changes her/his selection via online tools with no need for complex processes, engineer visits etc.

3.5.7 A simplified illustration of this three-layer model is shown below, and its worth noting that this applies to both fixed and mobile communication networks.



3.5.8 Therefore, when considering what level of consumer choice needs to be delivered by Ofcom's strategy, it is necessary to look forward to these and other examples for how choice is developing, rather than simply relying on the status quo.

3.5.9 We strongly believe that the best outcomes will come a vibrant choice of providers at each of the three layers in the above diagram, including the competitive supply of infrastructure at layer one.

Business and enterprise service providers

3.5.10 Again, for many businesses (especially SME's) the evolution of supplier choice and the increasing demand for simplified 'fat pipe' connectivity will follow similar trends as outlined above for residential services.

3.5.11 Larger enterprises are evolving towards the use of virtualised infrastructure. Cisco estimates that by 2018, 76% of data centre traffic will come from the cloud and that 75% of computing transaction will take place in the cloud[18]. This demonstrates the growth of computer Infrastructure as a Service (IaaS) which will place demands on high speed and reliable IP connectivity.

3.6 *Value for money*

3.6.1 Although this parameter could be considered straightforward, this may not be the case. If interpreted simply as achieving the lowest price possible, then it will mislead Ofcom's strategy. However, if it includes the need to provide the 'value' e.g. the product the consumer is seeking (and thus taking into account the need to ensure that services to meet consumer demand are delivered), then it could inform Ofcom's strategy differently.

3.6.2 CityFibre believes strongly that when considering how to deliver best value for money, Ofcom need to take the second of the two options set out above. Pricing should not be reduced as a stand-alone goal, but in the context of ensuring that the services likely to be demanded by consumers in 10 years can be developed and delivered.

3.6.3 The 'utility' value of broadband will increase as it supports more applications for more users and connected devices. Today, a family household of four is likely to have eight or more connected devices, and this will grow further with home automation and the IoT. Home access to better healthcare and education are other examples of growing utility value of a broadband connection over time.

3.6.4 Furthermore, ultrafast digital connectivity enables the creation of value in other parts of the digital supply chain; for example, in cost efficiencies and productivity gains through cloud computing.

3.6.5 Therefore, CityFibre strongly believes that infrastructure investments must not be de-valued though continual reductions in regulated wholesale access prices. If infrastructure is de-valued then investment incentives in ultrafast networks are reduced with potentially adverse impacts to the delivery of choice and services to consumers.

18 Cisco Global Cloud Index http://www.cisco.com/c/en/us/solutions/service-provider/global-cloud-index-gci/index.html

3.7 Summary

3.7.1 In this section we have put forward some of the parameters and criteria Ofcom need to take into account when designing their strategy for the next 10 years and beyond.

3.7.2 It is paramount that Ofcom's strategy has sufficient vision to deliver for the long-term future, rather than seeking short-term wins at the cost of delivering on the longer term demands that will play a significant role in the future of the UK as an economy and as a home to its citizens.

3.7.3 If Ofcom's strategy fails to focus on the ability to meet consumers' demands in 10 to 15 years from now, then the strategy is effectively designed to deliver a market failure for which it would be very difficult to conceive an effective remedy.

3.7.4 It is clear that significant investment in very high bandwidth connectivity will be needed to support a rapidly changing communication market.

4 Delivering Ofcom's strategic objectives

4.1 Where we are now

Technology deployment and capabilities

4.1.1 A range of technologies is currently available to deliver consumer broadband and business connectivity. Some of the key technologies are described in the table below, focussing on fixed network technology.

Technology	Scope of Deployment	Capability
FTTC/VDSL	Extensive deployment by BT for Superfast broadband	Proven technology – widely deployed <100Mbit/s, asymmetrical
G.FAST	BT trials in 2015, first deployment in 2016/2017	Unproven – deployed in trials only Depending on length of copper tail, 100-500Mbit/s asymmetrical. Likely to suffer from reliability problems
DOCSIS 3.0	Extensive deployment by Virgin for Superfast broadband	Proven technology – widely deployed 200Mbit/s asymmetric, highly contended.
DOCSIS 3.1	Virgin lab trials announced.	Unproven – deployed in trials only 1Gbit/s symmetrical (but unproven in commercial deployments)
FTTP (G-PON)	CityFibre, Sky and TalkTalk JV (York underway – other cities to follow)	Proven technology – widely deployed Currently 1Gbit/s G-PON; upgradeable to NG-PON2 10 Gbit/s and 1Gbit/s symmetrical.
FTTP (point to point)	CityFibre many cities (Zayo, euNetworks and others in London)	Proven technology – widely deployed >1gig and 10 Gbit/s symmetrical

4.1.2 The approach taken by BT Openreach in delivering broadband services has been to provide incremental upgrades to its access network using firstly ADSL to provide up to 24Mbit/s over copper, then moving to VDSL (FTTC) also over copper from the cabinet providing Superfast broadband up to 76Mbit/s.

4.1.3 We understand that an incremental approach to provision of Superfast broadband was believed to be an appropriate solution for the UK when the decision was made in 2011[19], and has resulted in improved average broadband speeds. However, we also note that in many countries, FTTP has been a preferred solution for provision of superfast broadband, and that this provides a platform able to provide considerably higher speeds in the future.

4.1.4 BT's future plans are primarily based on continued rollout of VDSL coupled with selected rollout of G.FAST technology. In summary, BT's current strategy is to continue to rely on the copper access network.

19 International Case Studies – Final Report for Ofcom by Analysys Mason, 10 July 2015

4.1.5 G.FAST potentially increases the speed available over the copper – with the speed being dependent on the length of the copper loops. In order to achieve higher average speeds, it would be necessary to extend the fibre backhaul connections to the active G.FAST cabinet further into the access network to give shorter copper links.

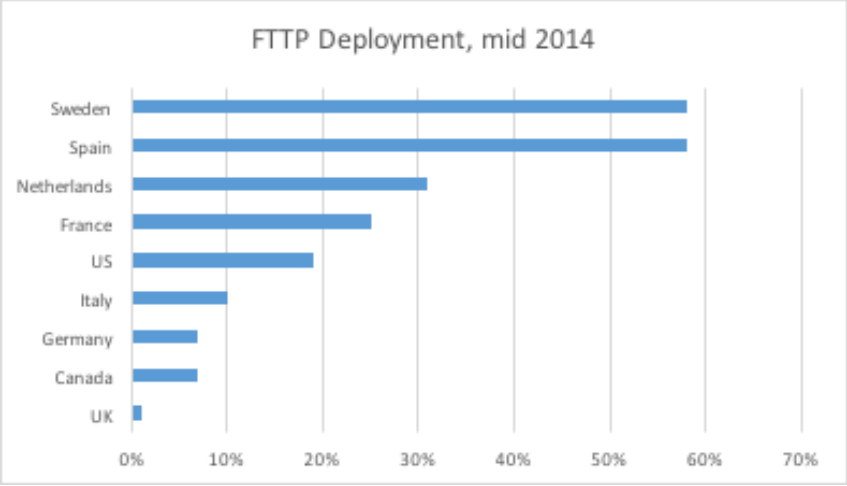
4.1.6 The costs of deploying G.FAST would still be considerable and the volume of active G.FAST cabinets could be very high (estimated by BT to be up to four million active cabinets) giving rise to operational difficulties and performance problems. We understand BT is considering an approach to limit the volume of G.FAST cabinets initially (potentially to the location of current FTTC cabinets), however, this could have adverse impact to speed and quality as the copper loops would be much longer. This demonstrates a compromise of using this technology. Furthermore, G.FAST would deliver highly asymmetrical services which are not aligned with the developing needs of broadband use as well as the IoT.

4.1.7 Virgin Media's cable network, predominantly based on DOCSIS technology, covers circa 50% of UK premises. Virgin has announced plans to expand its network to a further four million premises by 2020[20], enabling coverage of 17 million premises. DOCSIS 3.0 is able to support speeds >100Mbit/s and is upgradeable to DOCSIS 3.1 to deliver faster speeds in future.

4.1.8 We note that Virgin Media's local access network is not an open wholesale network and is therefore closed to other retail CPs.

Competitive Investments in FTTP are starting

4.1.9 The UK lags other countries in deployment of FTTP. The chart below shows an extract of FTTP coverage by country in 2014[21].



4.1.10 However, the current UK regulatory environment has enabled the opportunity for other infrastructure based CPs to start investing in the deployment of FTTP access networks; serving both residential and business customers as well as providing wholesale access to

20 http://about.virginmedia.com/press-release/9467/virgin-media-and-liberty-global-announce-largest-investment-in-uks-internet-infrastructure-for-more-than-a-decade

21 Analysys Mason: Final Report for Ofcom: International Case Studies 10 July 2015

other CPs. CityFibre and Gigaclear are two examples of infrastructure based CP's delivering 1 Gbit/s broadband over FTTP networks.

4.1.11 Therefore, despite Ofcom's focus on service-based competition and the resulting creation of the functionally separated Openreach, CPs have been able to create successful financeable business cases for investment in fibre access networks.

4.1.12 Whilst current deployments of FTTP by CPs competing with Openreach are at an early stage, they are proving FTTP network design, the economic models for deployment, and the substantial consumer demand. Therefore, these models for FTTP deployment are highly scalable if the regulatory environment supports pro-competitive fibre investment.

4.2 What type of infrastructure investment is needed in the UK?

4.2.1 The table below[22] shows a forecast of global broadband subscriber shares by technology.

Global Share of Subscribers	2014		2020		Change
	Subscribers (m)	Share	Subscribers (m)	Share	
Copper DSL (ADSL, VDSL, G.Fast)	366	51.5%	304	37.4%	-16.9%
FTTP (FTTH/B)	191	26.9%	335	41.1%	74.9%
Cable Modem	141	19.9%	164	20.2%	16.2%
Other	12	1.7%	11	1.3%	-12.5%
Total	711	100.0%	814	100.0%	

4.2.2 This forecast shows, globally, a considerable increase in the deployment of FTTP (+75%) and modest increase in cable (+16%) over the next five years. It forecasts a decline in the use of copper based technologies (-17%). This trend is unsurprising, and indicates the need for FTTP infrastructure capable of delivering gigabit services to customers.

4.2.3 Given the present coverage of FTTP in the UK of around 1%, compared with over 50% in some European countries, it is clear that a great deal of investment in FTTP infrastructure will be needed if the UK is to catch up with global norms.

4.2.4 We also note that BT's access network is unsuitable for incremental upgrade to FTTP by installing fibre in existing ducts (as local access ducts are congested, collapsed or many of the copper cables are directly buried in the ground without ducts) – therefore, installation of new access ducts will be needed in many areas. [Note, for these reasons, Passive Infrastructure Access (PIA) is also an unworkable solution at scale.]

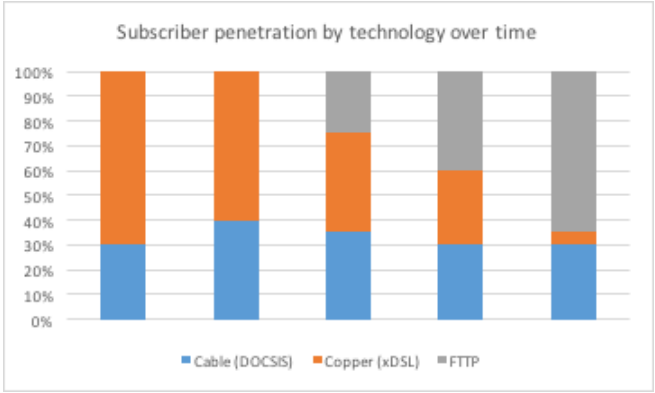
4.2.5 G.FAST technology requires very short copper tails (and hence considerable installation of new fibre towards the customer premises). It is reported that G.FAST is best suited to medium/high density urban areas; in less dense rural areas the copper tail lengths tend to result in smaller speed advantages over VDSL-based FTTC.[23] Such urban areas will tend to coincide with areas where FTTP is commercially feasible, making the deployment of G.FAST an unnecessary compromise.

22 Broadbandtrends: Global Fixed Broadband Subscriber Forecast (2015-2020), March 2015

23 http://www.telecomtv.com/articles/fttx/bt-says-that-its-g-fast-trials-prove-the-potential-for-gigabit-over-copper-sort-of-11757/

FTTP displaces copper based technologies

4.2.6 The chart below illustrates the effects of market share of access technologies following the introduction of open access FTTP in the Swedish market.[24]



4.2.7 It can be seen from this analysis that FTTP was introduced in a competitive environment alongside existing copper technologies (VDSL) and cable (DOCSIS). Over a three-year period, a majority copper based subscribers migrated to the new FTTP networks.

4.2.8 FTTP networks in Sweden are open access, so the fast pace of FTTP adoption may have resulted from retail CPs migrating customers to the new FTTP infrastructure if wholesale access pricing of fibre loops is broadly comparable with wholesale prices of copper VDSL. The lower effect on cable is explained by the cable networks being a closed vertically integrated platform.

4.2.9 This example provides a potential model for the deployment of FTTP in the UK market in a pro-competitive environment, where open access FTTP networks built alongside copper will enable timely migration to FTTP; with DOCSIS further enhancing the benefits of further infrastructure competition in Cable markets.

4.2.10 Overtime copper will be displaced and can eventually be retired (assuming that the incumbent also migrates retail customers to new FTTP infrastructures).

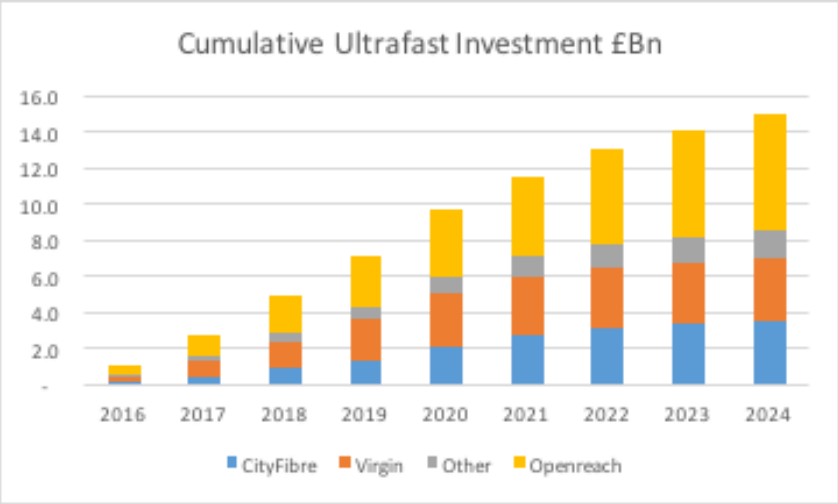
Investing in FTTP deployments

4.2.11 As mentioned above, the UK is now witnessing a wave of investment from new infrastructure based CPs who are building FTTP access networks; serving both residential and business customers and offering wholesale access to CPs. There is significant appetite and plans underway to accelerate these investments subject to a supportive regulatory environment.

4.2.12 The chart below illustrates the likely investments in fibre infrastructure to provide ultrafast services over the next ten years, based on known plans as a starting point and projecting forward. We have assumed that Openreach's investment provides the balance of investment

24 Ventura Team study of FTTP penetration in Sweden: FTTH Against the Odds – 10 Lessons, 2015

needed to achieve a total of £15Bn investment by 2024, over and above that which is projected by other operators.



4.2.13 The above chart assumes £15Bn[25] to reach circa 80% coverage of ultrafast, which is consistent with forecasts undertaken by Analysys Mason and Nesta (for example, it seems likely that £13-25Bn investment will be needed to provide comprehensive (80-100%) coverage of the UK with FTTP[26]).

4.2.14 The capital investment in the above chart assumes that FTTP is deployed from all providers with the exception of Virgin Media who retain the cable model using DOCSIS. Furthermore, it assumes that FTTP will be deployed in areas of current or planned cable deployment, thus retaining the model that cable will compete with copper and FTTP.

4.2.15 Some clear messages can be drawn from this chart:

- The trends in investment, based on plans of alternative operators, suggest that circa £8.5Bn (over 55%) of the required investment by 2024 could be provided by alternative infrastructure builders (CityFibre, Virgin and others) rather than Openreach.
- Circa £6.5Bn (less than 45%) of the required investment by 2024 could be provided by Openreach within normal capex commitment levels (i.e. less than £1Bn per year).
- Circa £3.5Bn will be invested in DOCSIS cable technology (VM's Project Lighting plus some further upgrades), and circa £11.5Bn in FTTP by multiple infrastructure builders (CityFibre, others and we have assumes Openreach will move to FTTP overtime).
- Assuming limited duplication of FTTP investment to residential homes in the same geographic areas (i.e. a deployed open access FTTP network is not overbuilt by another FTTP network (or G.FAST) during the construction period to 2024), then FTTP coverage would reach circa 20 million premises.

25 CityFibre's estimation based on known deployment costs from FTTP projects built and underway in the UK.

26 Exploring the costs and benefits of FTTH in the UK: Nesta, March 2015

- Virgin Media's plans would enable further infrastructure competition from cable in circa 17 million premises.[27]

4.2.16 The competitive pressure on BT to deploy an all-fibre infrastructure would allow BT to retire its copper network over time, and a competitive fibre access market would allow Ofcom to reduce the level of their regulatory intervention.

4.2.17 If the CPs were to withdraw from such investment due to adverse regulatory action, then it seems highly likely that Openreach investment would diminish (or remain focussed on VDSL and G.FAST), resulting in a significant shortfall in investment needed to achieve FTTP coverage.

4.2.18 Regulatory remedies must not be allowed to inhibit pro-competitive investment in FTTP; the emerging trends of CP investment in this area should be nurtured rather than stifled (while accepting that regulatory remedies will be needed ensure delivery of infrastructure to areas that will remain challenging for competitive infrastructure investment).

4.3 Which regulatory approach will deliver the best outcome

The role and benefits of infrastructure competition

4.3.1 In the DCR Ofcom ask stakeholders to submit views and evidence on whether promoting effective and sustainable competition remains the appropriate strategy to deliver sufficient investment and widespread availability of services for the majority of customers.

4.3.2 In our view, the promotion of effective and sustainable competition is the single most important and fundamental principle Ofcom should apply. A dynamic and competitive market at all levels of infrastructure and service provision has been proven to deliver significantly superior outcomes compared to market outcomes where only parts of the value chain are competitive.

4.3.3 CityFibre has networks in over 60 towns and cities throughout the UK, with over 30,000 km of fibre in the ground. CityFibre's core investment plan is based around £3.0bn of projected infrastructure investment over the next 10 years and involves laying open access wholesale dark fibre infrastructure in circa 100 UK towns and cities. The ability to invest in such networks is based on its business model which demonstrates sufficient return to investors, initially relating to the build of core network for business connectivity, and followed by further investment to extend the network to reach residential premises and allowing CPs such as Sky, TalkTalk and others to provide gigabit FTTP broadband services to homes.

4.3.4 As submitted in its response to Ofcom's 2015 BCMR consultation, CityFibre believes that infrastructure competition can deliver a vibrantly competitive digital communications market in the UK based on fit for purpose modern networks enabling a high penetration of FTTP connections to homes and businesses.

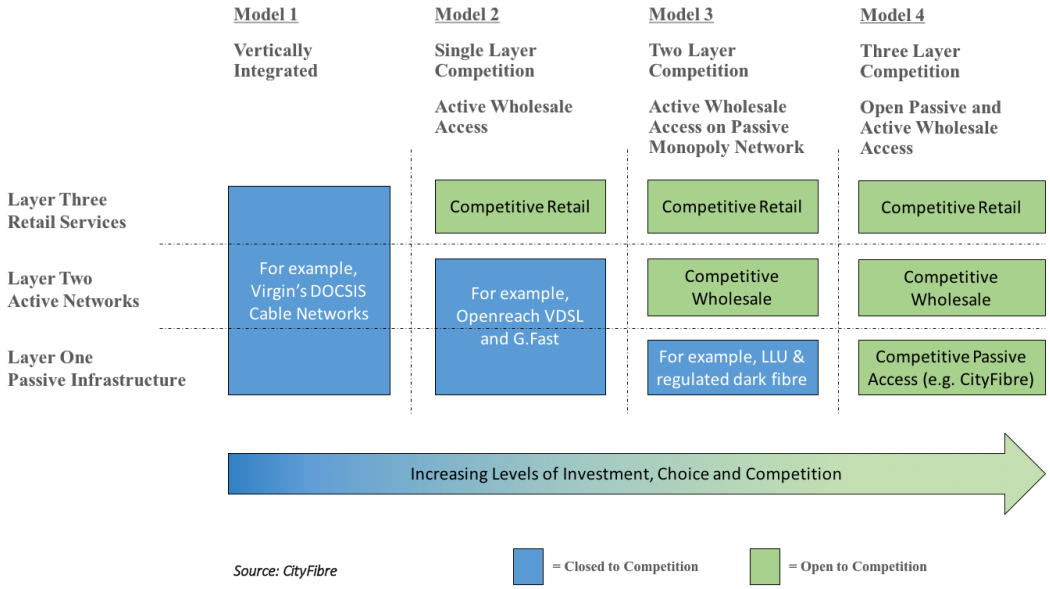
4.3.5 It is our strongly held view that competition throughout the supply chain can and will deliver vastly superior results when compared to the option of a market that is primarily based on regulated access to BT's infrastructure. This would be true even if BT had invested in modern

27 http://about.virginmedia.com/press-release/9467/virgin-media-and-liberty-global-announce-largest-investment-in-uks-internet-infrastructure-for-more-than-a-decade

access networks, but as BT still relies heavily on its old copper access infrastructure, investment in modern FTTP infrastructure by other CPs is even more critical.

Impact of different competition models

4.3.6 The approach to competition may be considered in relation to the commonly used three-layer network model.[28] The diagram below shows four models of competition.



4.3.7 Currently, the UK has a number of the above models in operation, as illustrated by the examples used in the diagram. We believe Ofcom must consider which model (or combination of models) that should be encouraged to maximise quality, choice and value for consumers. Furthermore, in recognising the need of greater FTTP rollout, Ofcom should take into consideration which model (or combination of models) will promote timely investment in FTTP infrastructure.

4.3.8 CityFibre believes the trend for superfast and ultrafast rollouts based on current incumbent plans from BT Openreach (Model 2) and Virgin Media (Model 1) will not deliver best outcomes, as it limits competition and also relies heavily on investment from just two providers.

4.3.9 Whereas copper LLU created the opportunity for competitive wholesale supply (by CPs putting their DSL equipment in BT's exchanges to gain access to unbundled copper loops), BT's strategy to deploy VDSL has resulted in Openreach regaining control of the active layer. In competition terms this was a backwards step. G.FAST would maintain Openreach's stranglehold of the active layer and limit innovation.

28 For example, as discussed in the European Commission Guide to High Speed Broadband Investment, Release 1.1, 22 October 2014

4.3.10 Model 3 will have limited scope, unless FTTP is mandated and the access network is considered a monopoly. In an environment where Virgin and BT have opted for Model 1 and Model 2 respectively, and FTTP is being delivered by alternative competitive suppliers, it seems very unlikely that Model 3 will deliver appropriate outcomes, and a Openreach monopoly would be a further backwards step.

4.3.11 However, Model 3 is proposed by Ofcom in its recent BCMR consultation, and appears consistent with the approach to infrastructure competition suggested by the Ofcom's DCR consultation (which seems to support a focus on passive remedies – even likening the benefits of this type of access-based competition to that of infrastructure competition). We believe this is a fundamental error, as evidenced in detailed in our response to the BCMR consultation.

4.3.12 We believe a two-layer competition model whereby Openreach provides regulated dark fibre access at a prices which reflects its own costs, given BT's economies of scale as the current dominant operator, would foreclose passive infrastructure competition at layer 1, and investment in FTTP would reduce sharply.

4.3.13 CityFibre believes that Model 4 above, where investment and competition is promoted at all three layers will deliver best outcomes for both investment and also for quality, choice and value for consumers. Whilst it may not apply to all geographic markets in the UK (for example, some very remote low density areas may not justify competing infrastructure), we believe it should be promoted where possible. Care must be taken not to impose regulation that inadvertently destroys or denies the opportunity for competitive investment in passive infrastructure.

4.3.14 The three-layer model allows for players who focus on a single layer (such as CityFibre's focus on passive infrastructure), as well as those who operate in two or more layers. At the current time there is considerable investment being made into passive infrastructure at layer 1 by competing suppliers, and this is set to increase.

4.3.15 Where investment is made in competing access infrastructure, the competitive dynamics change significantly from the situation where service-based CPs can only compete based on access to BT's wholesale services. Existing and planned investment in competing access networks is creating competitive physical networks across the UK. These are not limited to just the very largest cities, as deployments are underway in tier-2 cities, towns and villages.

4.3.16 For example, in relation to CityFibre:

- Investment in Coventry and York is creating the base for substantial improvements in the competitiveness of these cities as well as improving conditions for the public and private entities to benefit from the digital economy[29].

- In the past year, CityFibre has committed significant investment to rollout FTTP networks in Peterborough, Kirklees, Newport, Aberdeen, Edinburgh and Hull in our Gigabit City model.

29 http://telecoms.com/interview/a-tale-of-two-gigabit-cities/

- In York, the expansion of FTTP to residential homes is underway in conjunction with our JV with Sky and TalkTalk, bringing affordable gigabit broadband to residents and small businesses under the Ultra-Fibre-Optics UFO brand.

- Our national framework agreements with EE/Three/MBNL and Vodafone provide CityFibre with a scalable opportunity for urban backhaul infrastructure across many UK towns and cities, including the UK's first citywide dark fibre backhaul network.

- Our growing potential to accelerate rollouts into more cites through select acquisition of existing duct and fibre infrastructure[30].

4.3.17 The three-layer model also allows for an open access approach whereby fibre infrastructure builders at layer 1 provide access services to multiple players downstream. For example, CityFibre is deploying FTTP in York, supplying passive network services to both Sky and TalkTalk who then provide retail services to consumers. It would not be economic for either Sky or TalkTalk to invest in such infrastructure individually (due to lack of individual scale), but the open access model allows both players to benefit from the scale economies available from CityFibre's strategy for open wholesale networks.

4.3.18 Therefore, the aggregation of wholesale demand at layer 2 can enable sufficient scale economies for infrastructure investors to deploy open access passive FTTP infrastructure at layer 1. Once deployed the new FTTP networks remain open to all other CPs (including the retail arms of incumbent operators).

4.3.19 The table below compares the likely impact of the 3-layer competition model and Ofcom's model on investment levels, timescales, service functionality and quality.

Parameter	**Model 4** **Three-layer competition**	**Model 3** **Two-layer investment model** (for example Ofcom model as outlined in the BCMR consultation)
Level of Investment	Competition at the passive layer would leads to significant investment in FTTP infrastructure by CPs and Openreach.	Investment in the passive layer will be foreclosed to CPs and reliant on Openreach. Overall investment will be drastically lower unless state funded.
Deployment timescales	CP investment is already accelerating, and the trend is set to continue.	If this model is pursued, then it will lead to rapid reduction in CP investment. Availability of regulated passive infrastructure will not be until 2017, and further delays are possible.

30 ✂

Parameter	Model 4 **Three-layer competition**	Model 3 **Two-layer investment model** (for example Ofcom model as outlined in the BCMR consultation)
Service functionality	CP investment will deliver FTTP/DOCSIS, able to support Gbit/s speeds. Openreach is likely to follow suit in order to compete.	Investment will be primarily in G.FAST, delivering sub-Gbit/s speeds. It seems implausible that the UK could catch up with other countries in the availability of ultrafast services.
Innovation potential	Competition at all three layers with wider availability of open access FTTP will enable significant innovation.	The active wholesale nature of G.FAST and DOSCIS does not allow CPs to innovate at the active layer. Therefore, innovation will be limited to business connectivity market only if dark fibre is mandated.
Service quality	Rapid migration to all-fibre infrastructure will deliver significantly improved service quality in the areas of provisioning and fault rates. The presence of several access networks will increase incentives to improve QoS delivery.	UK infrastructure will remain dependent on copper and cable for a lengthy period, which will make significant improvements in service quality difficult to achieve. End-to-end fibre will be confined to the business connectivity market.

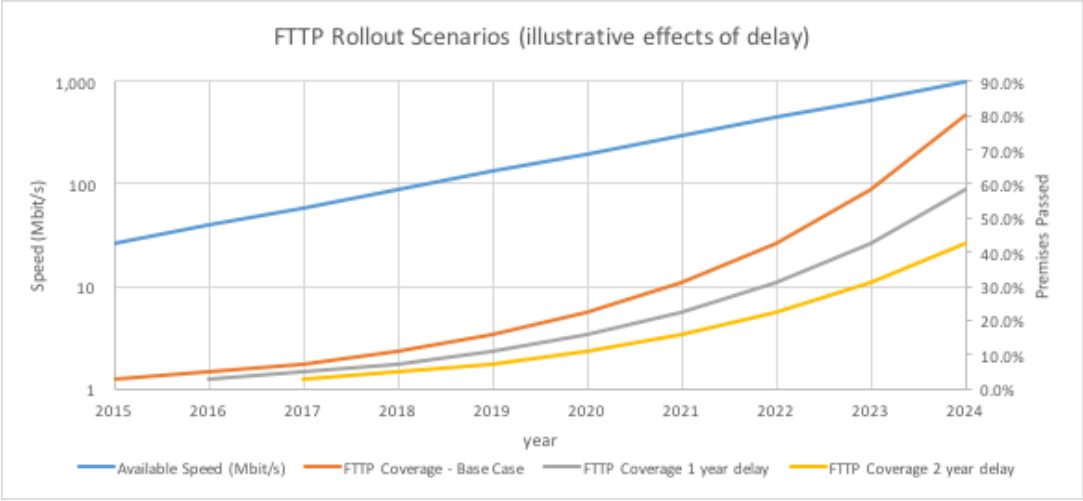
4.3.20 Virgin Media's planned £3.0b Project Lighting investment will further its rollout of a closed vertically integrated DOCSIS network (Model 1). Whilst Virgin's investment should be welcomed, to bring competitive balance to the market we believe it is vital that the most competitive model for infrastructure and service competition is also encouraged.

4.3.21 Therefore, CityFibre is strongly of the opinion that the 3-layer competition model (Model 4) is the most appropriate approach to provide rapid transformation of the UK's network infrastructure over the next 10 years in order to meet consumer needs.

Ensuring efficient and quick rollout of FTTP and ultrafast services

4.3.22 Having established that competitive supply of FTTP is vital for the UK to be a leading digital nation, we believe that Ofcom must consider the regulatory environment that enables a quick and efficient nationwide rollout.

4.3.23 The impact of delays to the delivery of comprehensive FTTP infrastructure is considerable. The chart overleaf shows a base case deployment (assuming current investments continue), and scenarios showing the impacts of 1 and 2-year delays to investment.



4.3.24 The chart above is illustrative, and maps (in blue) against the left axis the expected demand of UK broadband speed following Nielsen's law (as detailed in 3.2.8 above). The FTTP coverage of the base case (in orange) is mapped against the right axis to achieve deployment to 80% of premises by 2024, to coincide with the demand for 1Gbit/s. This assumes the deployment of £15Bn of capital in a pro-competitive environment (as detailed in 4.2.12 above).

4.3.25 In the base case, the emerging investments in FTTP infrastructure accelerate (following a period of design, planning and mobilisation), and result in the target FTTP coverage of 80% of premises by 2024. But delays in the investments will cause significant reductions in the coverage achieved over the next 10 years.

- With a one-year delay (in grey), the coverage of gigabit services falls to circa 60% of premises by 2024.
- With a two-year delay (in yellow), the coverage of gigabit services falls to circa 40% of premises by 2024.

4.3.26 Therefore, we believe that Ofcom's approach to future regulation must seek to avoid delays to investment in FTTP infrastructure. Investors will seek a stable regulatory environment that provides confidence of a predictable return to investors.

4.3.27 Furthermore, infrastructure investors expect the physical passive infrastructure to retain its 'yield' generating value over the longer term.

4.3.28 CityFibre view the following as current regulatory risks that threaten investment certainty and would cause a significant delay of FTTP build of >2 years:

- ***The implementation of the BCMR passive remedies as proposed by Ofcom resulting in a devaluing of passive infrastructure with adverse impacts to investment incentives.***
- ***Structural separation of Openreach could that could easily result in lengthy delays to investment due to the complexity of defining and implementing the chosen solution, and the uncertainty created for investors and CPs.***

Defining layer-1 infrastructure competition

4.3.29 In the DCR, Ofcom appear to have adopted new terminology. The term 'infrastructure competition' is used by Ofcom when referring to competition based on passive access to BT's infrastructure, whereas 'end-to-end competition' is used when referring to competition between competing infrastructures.

4.3.30 CityFibre does not agree with this terminology and believes that referring to access-based competition as infrastructure competition is misleading. Suggesting that access-based competition is infrastructure competition associates a higher level of benefits than would be realisable when compared to competition between competing layer 1 infrastructures.

4.3.31 Competition based on dark fibre, for example, is still subject to the network topology and the quality of service performance of the access provider. For example, BT's local access network is typically constructed based on the 'tree and branch' design associated with the historical structure of BT exchanges deployed for voice PSTN. Therefore, if passive access were provided based solely on BT network, CPs would be denied the innovation that can come from high capacity modern infrastructure based on rings and point to point fibre. Even access to duct would still tie providers to the access provider's network topology.

4.3.32 Furthermore, it is known that the majority of BT's local access network is based on copper wires, especially in the last mile connection to the premise. LLU provided CPs with access to passive copper loops, however, the drive to superfast broadband has resulted in a shift back towards active access, as SLU and PIA are effectively unworkable due to the problems of BT's access network topology, exacerbated by the absence of fibre in BT's last mile connectivity.

4.3.33 Therefore, services based on regulated access to BT's fibre infrastructure will be limited to a small number of applications in backhaul and business connectivity markets, as without layer-1 competition it is likely that BT's copper local loops will continue to entrench a dependency on active access using VDSL and G.FAST.

4.3.34 For the reasons above we believe that Ofcom must refrain from referring to passive access remedies as infrastructure competition. Electronics should be considered as part of the layer 2 and layer 3 services.

4.3.35 Further, Ofcom should consider the emergence of open access wholesale network providers, such as CityFibre, competing directly with BT Openreach. As these providers do not operate as vertically integrated providers of retail services, they appear to not be covered by Ofcom's new definitions. It is CityFibre's view that the economic benefits that could be realised by the development of competitive open access fibre access networks would substantially outweigh the benefits of investment in vertically integrated networks and businesses.

4.3.36 Reference materials and research use the term infrastructure competition referring to physically separate networks, not to passive access to the incumbent's network. All analysis in this response should therefore be read as such – that is – the term infrastructure in this response is equivalent to Ofcom's term end-to-end competition. CityFibre does not recognise the use of a separate term for competition based on passive access.

4.3.37 CityFibre is concerned at Ofcom's proposed new terminology as it suggests a preconception of substantially increased benefits from the use of active access compared to the use of passive access.

4.3.38 CityFibre does not dispute that there are additional benefits that can be derived from the use of passive access, but contests that these incremental benefits are of such a magnitude to justify the term infrastructure competition, which could mislead and undermine potential investor appetite in true competing layer-1 infrastructure.

4.3.39 There is considerable academic and empirical evidence that supports the significant additional benefits arising from true infrastructure competition, relative to the benefits available for service competition only. This is described in Annex A.

Static efficiency

4.3.40 Ofcom, correctly, states that end-to-end competition exposes the whole value chain to competition and thus encourages efficiency in structure and operation of networks[31] . Ofcom then, however, proceed to state that as 'duplication of assets' increases average costs and therefore access based competition may have a higher level of static efficiency than true infrastructure competition.

4.3.41 Here Ofcom appear to be of the misconception that investors in new future-proof networks are simply 'duplicating assets' when in fact the networks being constructed are of a different design and topology and are designed to deliver ultra-high speed connectivity to businesses and residential premises and homes.

4.3.42 BT's current network could not replicate the functionality of these new networks and it is a flaw in Ofcom's analysis to consider it as a simple duplication of assets.

Dynamic efficiency

4.3.43 Ofcom recognise that dynamic efficiency incentives will be reduced if cost-based access remedies are applied, which do not sufficiently reward the investment risk taken[32] . However Ofcom appear to consider that this risk can be substantially mitigated by the imposition of passive remedies (especially duct and pole access) as this type of access may produce nearly the same levels of dynamic benefits as true infrastructure competition[33] .

4.3.44 CityFibre fundamentally disagrees with the assumption that passive access remedies can replicate the dynamic benefits that arise from true infrastructure competition, whether as vertically integrated end-to-end providers or as open access wholesale platforms.

4.3.45 Dynamic benefits from true infrastructure competition include not only any improved services an access seeker could possibly provide using passive access, but the benefits from improved network topologies and technologies as well as improved network performance and quality of service resulting from competing network providers' effort to attract retail and wholesale customers.

31 DCR s. 9.16

32 DCR s. 9.21

33 DCR s. 9.19

4.4 The impact of regulatory decisions on investment

Background

4.4.1 There is nothing inevitable about investment in fibre networks. Large international investors, such as Liberty Global, Zayo, CityFibre and euNetworks have the freedom to invest in countries that most support independent infrastructure competition. Our concern is to ensure that the UK is an investment destination of choice for such firms and that effective competition between independent infrastructure providers delivers benefits to customers, citizens and the UK economy.

4.4.2 Stability, transparency and predictability of regulations is of paramount importance for investors. The introduction of major change can cause long delays and lasting radical changes to the investor attractiveness of the market.

4.4.3 Ofcom have, since their last strategic review in 2005 (the TSR), pursued a strategy focused more on service competition than on infrastructure competition. This was informed by the TSR outcome and by the (then accurate) market sentiment that there was not sufficient demand to justify investment in alternative access infrastructure. The tech crash in 2001 and the relatively slow growth in capacity requirements made Ofcom's conclusions understandable.

4.4.4 Since 2005, however, market characteristics have changed considerably. Demand has 'caught up' with the capabilities of copper access networks and has justified the wide-ranging roll-out of local access fibre to the premises networks (FTTP) across many parts of the world, including in many of our EU neighbours.

The impact of Ofcom's decisions

4.4.5 To encourage investment in network and services, Ofcom must adopt a presumption that infrastructure investment is feasible and that markets are contestable, unless proven not so.

4.4.6 In the recent past, and particularly in the current BCMR consultation, it would appear that Ofcom have adopted to opposite presumption, namely that investment in alternative infrastructure is not feasible and that the whole of the UK with the exception of business connectivity in the Central London Area (CLA) is not a contestable market. Therefore, Ofcom incorrectly conclude that large parts of the UK are not prospectively competitive even though several CPs are making substantial investments.

4.4.7 When reviewing how Ofcom's decisions impact on investment incentives, it is necessary to look at the full hierarchy of decisions, not just the final headline outcomes.

4.4.8 For example, the impact of a decision on price regulation is not just the actual level of price changes required, but the underlying decisions on how, where and why the regulation is applied. It is therefore important to consider at least three levels:

- The definition of the product market covered
- The definition of the geographic market covered, and
- The criteria used to determine whether the market is competitive or be subject to regulatory intervention.

4.4.9 Whilst Ofcom are to a certain extent bound by the EC framework regulations, they still retain substantial discretion to decide on these parameters.

4.4.10 Transparency, consistency and predictability are paramount in creating a pro-investment market. The absence of one or more of these results in a significant increase in regulatory risk and presents a direct disincentive to investment.

Definition of product markets

4.4.11 When defining product markets, CityFibre considers that Ofcom should put at least as much emphasis on supply-side substitution (existing and emerging) as on demand-side substitution. This would ensure that separate markets would be defined if some products face (or are likely to face) a higher level of supply-side substitution than others. Having defined a separate market it would then be possible to limit the regulation to the product set facing the lower level of supply-side substitution.

4.4.12 Not recognising the varying levels of competition for different products would result in over-regulation of some products and very possibly in reduced investment resulting from that over-regulation.

4.4.13 Ofcom's proposals for product market definitions in the BCMR consultations, include a single for all speeds of CISBO services, regardless of the fact that the level of competition varies considerably between lower speeds and very high speeds. This is an example of over-simplification of the market definition, perhaps with the intent of reducing complexity or perhaps for other reasons.

4.4.14 For Ofcom to pursue a strategy of promoting competition as deeply into the network as possible, the approach to product market definitions in the future must be one that seeks to avoid over-regulation, where necessary through the definition of markets on a more granular level. Whilst this may cause an increase in the monitoring and enforcement of the resulting remedies, the alternative could be significant reductions in investment and resulting reductions in competition, innovation and economic benefits to consumers, citizens and the UK economy overall.

The definition of geographic markets

4.4.15 As mentioned above, infrastructure competition is developing in many locations, or 'islands' across the UK (and may in due course spread further from these 'islands'). It is therefore important that when defining the relevant geographic area for a market, that again the supply-side substitution part of the analysis is given substantial weight.

4.4.16 In doing this analysis, it is important to recognise that there is often a lag effect between the construction of competing infrastructure and the changes in market shares. This is the reason why it is equally relevant whether a geographic market is prospectively competitive as whether it is presently competitive. Arguably, the damage of overregulation is likely to be larger in prospectively competitive markets than in fully competitive markets, as the prospectively competitive markets rely on continued investment in order to become effectively competitive. Failure to recognise present or prospective competition in specific geographic sub-markets would lead to over-regulation which would most likely remove the incentives to invest in these markets.

Criteria to determine whether a market is competitive or prospectively competitive

4.4.17 The EU regulatory framework mandates the application of the Three Criteria Test, whereby a regulator is required to assess whether a relevant market is subject to significant enduring barriers to entry and development of competition, whether the market is characterised by and tendency towards effective competition, and whether any arising competition problems could be sufficiently addressed by the application of competition law through the courts. These tests are to determine whether the relevant market is susceptible to *ex-ante* regulation (and therefore whether the regulator should undertake additional analysis to determine whether a provider has significant market power (SMP) and, if so, what remedies should be applied to prevent the abuse of such market power.

4.4.18 If the relevant market has been defined too widely, as described above, then the determination of whether the market is susceptible to ex-ante regulation is complicated by the market not being homogenous. Often in cases like this it is decided that the market is susceptible to competition, even if this is true to only parts of the market.

4.4.19 Having determined whether the market is 'susceptible to ex-ante regulation' Ofcom then have to determine whether a provider holds significant market power (SMP) and whether that provider is likely to abuse that position. That analysis is likely to follow the pattern of the preceding analysis, determining SMP for the whole market even if in fact only parts of the market justify this.

4.4.20 Only after determining SMP do Ofcom determine what remedies need to be imposed on the SMP provider which results in the headline regulatory result.

4.4.21 CityFibre is aware that Ofcom are very familiar with the processes for market reviews. The purpose of the above overview is to illustrate that a pro-infrastructure investment policy needs to permeate down into all of Ofcom's processes. It is natural that Ofcom would seek to protect consumers and citizens from abuse of market power and therefore may err on the side of caution when determining whether certain products or geographies require less or no regulatory intervention. The cost of that caution, however, could be that a market that was prospectively competitive will move 'backwards' and become less competitive due to over-regulation.

4.4.22 Recent experience of Ofcom's BCMR consultations suggest that at present, Ofcom do not pursue a pro-infrastructure investment policy, but rather a service competition policy, and this is a major concern for CityFibre.

Ofcom's approach to wholesale pricing

4.4.23 Despite Ofcom's regulation of BT's pricing, several infrastructure based CPs (including CityFibre) have managed to establish successful businesses that have attracted substantial private funding. It is, however, critical that Ofcom does not regulate BT's prices below the level where efficient network providers can remain attractive for private investors.

4.4.24 Proposals from Ofcom to impose further aggressive price reductions on BT and to mandate the provision of dark fibre access at extremely low prices, would most likely undermine the incentives of the competitive infrastructure CPs to pursue their planned investments, simply because it will not be possible to raise the necessary funding or because investments will be directed to more profitable opportunities, potentially outside the UK.

4.4.25 Ofcom's proposals for pricing of active and passive wholesale services under the BCMR review currently under way, are examples of regulatory decisions that would likely cause a significant reduction in competitive infrastructure investment. The cost level required to support pricing at the proposed level could only be achieved by an operator with extremely high market share (due to the very high economies of scale present in fixed networks).

4.4.26 CityFibre believes that the most appropriate method to derive a suitable cost base for regulation of BT's prices is to define the principle of *reasonable costs*, which would be costs calculated either using a Modified Equally Efficient Operator (MEEO) approach or a Reasonably Efficient Operator (REO) approach. This would allow for adjustments to the cost base to be made for different network topologies and different scale effects, as well as any other relevant factors that may be identified through more detailed analysis.

4.4.27 The use of costing approaches to determine wholesale product pricing which ensure the feasibility of market entry at different points on the investment ladder is widely established. For example, the Irish regulator ComReg in its approach to the wholesale leased line market[34] highlights the non-eviction principle and the application of an appropriate economic space. The European Regulators Group (ERG), in its Common Position papers,[35,36] supports the concept of an appropriate economic space between wholesale products. ARCEP, in its leased lines market analysis,[37, 38] sets out an approach regarding the application of the non-eviction principle, which ensures that wholesale tariffs set by France Telecom do not evict operators that have deployed their own infrastructure.

4.4.28 We also note the European Commission Decision in 2007 from Case COMP/38.7841034 relating to a proceeding under Article 82 of the EC Treaty where it notes that:

'It is therefore necessary that there should not be any margin squeeze in relation to any "step" of the ladder, i.e. in relation to any wholesale product. If there was such a margin squeeze, new entrants that are climbing the ladder of investment, would be foreclosed. … All national regulatory authorities agree that the process of climbing the ladder of investment can only be effective if there is a margin between all the steps of the ladder'

ComReg further note that:

*"The imposition of a **price floor** for WLLs should encourage OAOs onto the ladder of investment and encourage infrastructure investment while promoting sustainable competition in the retail market, based on the pricing mechanism established in this decision. This should also meet ComReg's regulatory objective to encourage infrastructure based competition, under Section 12 of the Act."*

34 ComReg: A final decision further specifying the price control obligation in the market for wholesale terminating segments of leased lines. Document 12/03 Decision D02/12 2 February 2012

35 Report on ERG best practices on regulation regimes in wholesale unbundled access and bit stream access: ERG (07) 53 WLA WBA BP final 080604

36 Report on price consistency in upstream broadband markets June 2009: ERG (09) 21

37 ARCEP: Décision n° 06-0592 de l'Autorité de régulation des communications électroniques et des postes en date du 26 septembre 2006 portant sur la définition des marchés pertinents des services de capacité, la désignation d'opérateurs exerçant une influence significative sur ces marchés et les obligations imposées à ce titre

38 ARCEP: Décision portant sur la définition des marchés pertinents des services de capacité, la désignation d'opérateurs exerçant une influence significative sur ces marchés et les obligations imposées à ce titre Décision n° 2010-0402 en date du 8 avril 2010

4.4.29 The ERG states that:

"NRAs may want to pay attention to the relative prices of wholesale services on the value chain if their ultimate aim is to promote efficient investment in infrastructure (to the deepest level possible)."[39]

4.4.30 ERG also states, in the context of dealing with potential foreclosure and pricing:

"Furthermore, still according to this Common Position, NRAs must ensure that investment incentives are such that alternative operators are able to replicate the incumbent's infrastructure where this is technically possible and economically feasible."[40]

4.4.31 The EC's European Access Directive states:

"The imposition by national regulatory authorities of mandated access that increases competition in the short-term should not reduce incentives for competitors to invest in alternative facilities that will secure more competition in the long-term."

4.4.32 Ofcom's own analysis concerning superfast broadband services in its statement on the approach to the VULA margin[41] resulted in the use of a modified EEO approach to assessing costs, whereby BT's costs were adjusted to compensate for advantages they may have.

4.4.33 These references indicate a consensus among European regulators that in setting the prices for wholesale products, close attention should be paid to ensure adequate economic space between the different stages on the investment ladder. Ofcom's approach fails to achieve this in the following ways:

- It uses BT's cost base, without any adjustment for the economies of scale that a new entrant might achieve, and this results in active price reductions which undermine infrastructure-based operators at either the active or passive levels of the value chain;
- It does not recognise the benefits of modern network architecture, which may cost more than BT's CCA costs in the short term, but lead to more efficient outcomes in the longer term; and
- There is no provision for price floors on BT's active prices, which gives potential for BT to manipulate prices to undermine emerging competitors.

4.4.34 Ofcom, now have the opportunity through the DCR process to reassess its approach. Providing that the proposed BCMR active and passive remedies are not implemented, Ofcom will be starting the period post the DCR with a market where investment is actively pursued by a number of competing providers. This should be the ideal position for a regulator with a mandate to promote effective and efficient competition at all levels in the market.

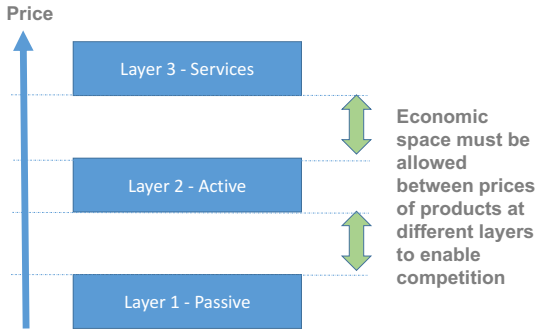
4.4.35 With reference to the 3-layer competition model described in Section 4.3, in order for competition to be enabled in all layers, Ofcom should ensure that the strategy developed

39 Page 2: Report on price consistency in upstream broadband markets June 2009: ERG (09) 21

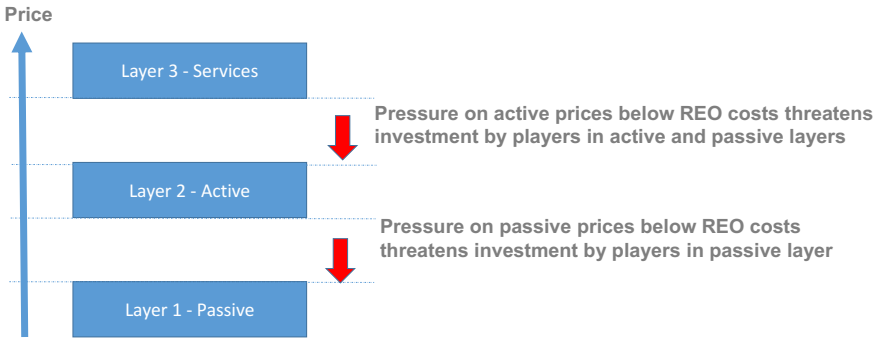
40 Page 4: Report on price consistency in upstream broadband markets June 2009: ERG (09) 21

41 Ofcom Statement: Fixed Access Market Reviews: Approach to the VULA margin 19th March 2015, para 5.54

allows for leaving sufficient economic space between the prices of products in different layers, as illustrated below.



4.4.36 Pricing either active or passive products below REO costs will jeopardise investment in active and passive infrastructure.



4.4.37 Ofcom have applied a lighter touch regulation approach to markets where BT has been making investment in new and riskier functionality. An example of the lighter touch approach is the application of the VULA margin squeeze test.

4.4.38 CityFibre supports the differentiation in regulatory approach to support investment and innovation, but it is important that Ofcom consider the investment by other parties than BT when identifying markets that qualify for the lighter touch regulation. The fact that BT has chosen to not invest in future-proof access networks (which are being widely implemented across the EU), should not mean that there should not be incentives and reward for that investment being undertaken by other CPs. To reserve investment incentives for BT would be discriminatory and a direct disincentive for competing CPs to invest in UK digital communications networks.

4.4.39 Using the non-discrimination regulation approach instead of conventional cost-based regulation increases investment incentives for BT as well as its competitors, provided that the non-discrimination test is designed to reflect the costs of BT's reasonably efficient competitors. Ofcom sought to achieve this through the modified EEO approach used in the VULA decision.

4.4.40 Given the current investment appetite in the market, other CPs are likely to invest alongside BT, resulting in a competitive infrastructure market. In this case, traditional charge controls are unlikely to be necessary except in areas where CPs have not rolled out competing infrastructure.

Defining efficient investment

4.4.41 Ofcom has in its recent BCMR consultations indicated that any network provider that cannot replicate BT's unit cost levels is by definition inefficient. CityFibre contests this in the strongest terms. Digital communications networks are characterised by substantial economies of scale, this is stronger for fixed networks, but present in mobile networks as well.

4.4.42 Taken at its extreme, this means that no investment in alternative network infrastructure is efficient, as no network can replicate the scale economies enjoyed by the incumbent monopoly provider.

4.4.43 Given the very substantial benefits derived from competition at all levels of the supply chain, this is evidently not a desirable conclusion. Ofcom has a duty to promote effective and efficient competition and it is therefore critical that Ofcom's strategy provides is a clear definition and that the definition does not effectively foreclose the development of competition at layer-1 for passive network infrastructure.

4.4.44 In our response to the BCMR consultation, we have presented analysis that shows that, at the same levels of scale, the CityFibre network would be more efficient than BT's.

4.4.45 CityFibre contends that efficient competition should be defined as the level of efficiency that could be achieved in a competitive market. ***The term 'efficient competition' becomes meaningless if the level of efficiency expected can only be achieved in a market without competition***.

4.4.46 Decisions by Ofcom to set regulated prices at a level that could not be achieved in a competitive market are a direct disincentive to competition. It is CityFibre's position that Ofcom would be in breach of its duties, were it to define efficient investment at a level that could not be achieved in a competitive market.

4.4.47 Further, Ofcom's lack of recognition of where competition has already emerged and where it is likely to emerge during the period of the BCMR review (reflected in how they have defined both product and geographic markets), means that Ofcom is applying extremely aggressive price regulation to products and in geographies where competition is already starting to make its mark. This is a direct disincentive for competing CPs to invest in towns and cities around the country.

4.4.48 It is not surprising that competition is not developing evenly across all products and the entire geography of the UK, so regulatory decisions must take into account the more granular market characteristics.

4.4.49 Additionally, Ofcom have changed their criteria for defining separate geographic markets, without providing a rationale or justification for this. This indicates a regulatory regime that is erratic and therefore presents a risk to investors.

4.4.50 Some members of the Infrastructure Investors Group (IIG) have received (confidential) comments from existing and potential investors that Ofcom's BCMR proposals have caused such uncertainty that they are no longer considering UK digital communications infrastructure to be a viable investment prospect.

4.4.51 CityFibre considers Ofcom's proposals in the BCMR consultations to be based on flawed analysis and a presumption against viable and efficient infrastructure competition.

4.4.52 Ofcom's analysis through the DCR should provide a context in which Ofcom can reconsider their BCMR proposals and the resulting strategy should set out a clear set of objectives and priorities that embrace the substantial value of competition in layer 1 as well as in layers 2 and 3.

Where to reduce or withdraw regulation and the erosion of enduring bottlenecks

4.4.53 Competition does not develop evenly across the country. We have mentioned earlier that competition tends to develop as islands which are likely to reflect the areas where the return would be the greatest for the competitive provider. An example of a competitive island is the CLA which Ofcom recently confirmed as being competitive for business connectivity services.

4.4.54 Until relatively recently, it was perceived that the fixed access network was an enduring bottleneck, perhaps even a 'natural monopoly', as the economics of constructing competing access networks, for business and residential connections alike, outside the CLA, was considered non-viable.

4.4.55 In recent years, however, the UK has seen the emergence of several companies investing in competitive local loop networks[42], focusing on both business and residential market. Furthermore, Virgin Media has actively upgraded its competitive local access infrastructure in its markets and committed to further expansion. A large number of towns and cities across the country are now either seeing active investment in fibre access networks or are included in investment plans for the next 5-7 years.

4.4.56 In York, CityFibre has rolled out a fibre access network for the business connectivity market and is expanding the fibre network for FTTP access to residential consumers in conjunction with Sky and TalkTalk – services are now available. The FTTP network is open at a wholesale level to other CPs. The collaboration with Sky and TalkTalk may be extended to other towns and cities, including cities where CityFibre has core infrastructure, and further to our target 100 towns and cities.

4.4.57 The emergence of these new access network providers fundamentally changes the competitive dynamics in the towns and cities where they construct their networks. It is now likely that many towns and cities will experience two or three competing access network providers. The benefits of true infrastructure competition (not the reliance on active or passive remedies) have been discussed extensively in section 4.3 and in Annex A and we will not repeat them here.

4.4.58 What is essential, however, is that Ofcom's strategy builds on this willingness to invest in what was previously considered an enduring bottleneck and which would traditionally have been regulated to ensure fair reasonable and non-discriminatory access to BT's network.

4.4.59 Ofcom's recent BCMR proposals to mandate passive access remedies priced at a level only BT can deliver would certainly have adverse impacts to the roll-out of competing access networks. CityFibre has presented separately in our BCMR submission to Ofcom (attached in Annex C) its analysis showing that this BCMR proposal was a result of flawed market definition analysis and a presumption against true infrastructure competition.

42 CityFibre, Zayo, euNetworks Gigaclear, HyperOptic, B4RN and KCOM are examples

4.4.60 In addition to the already presented benefits of true infrastructure competition, the investment in new fibre-based access networks in a pro-competitive environment (as illustrated in section 4.2.12) offers to remedy the current situation where the UK is the EU country with the lowest deployment of FTTP infrastructure.

4.4.61 Whilst the Analysys Mason report commissioned by Ofcom for the DCR presents an explanation of why BT has selected to not invest in FTTP roll-out in 2012, that explanation does not change the fact that the UK should not consider it unable (or unwilling) to deliver gigabit FTTP services when the majority of our EU neighbours will.

4.4.62 Judging by past experience, it is unlikely that BT will move to invest in FTTP unless it feels pushed to do so by the presence of competition.

Where to apply public policy action

4.4.63 CityFibre acknowledges that there are some geographic markets where the development of competition is unlikely to be viable (barring the development of new low-cost technologies) and where policy action may be required to extend the benefit of FTTP to all citizens.

4.4.64 It is, however, equally important that such action is implemented in a targeted manner and only after careful evaluation of prospective market entry and competition, so as to not endanger the roll-out of competing networks which can deliver much superior results for the large proportion of UK citizens, compared to access-based competition using an outdated technology.

4.4.65 It is also important to understand that areas that were considered enduring bottlenecks only a few years ago – such as the fixed access network in medium-sized towns and cities – are now experiencing investment in competing access infrastructure. The selection of geographic areas in which to apply public policy action are carefully considered and that any action taken causes the minimum market disruption possible.

4.4.66 We note that BT has reported excess profit of circa £4Bn[43] has been made at the same time as BT receiving circa £2Bn of public subsidy via the BDUK programme to deliver super-fast broadband. Therefore, it seems clear that there must be stronger policies in place to ensure that BT is reinvesting excess profit into its infrastructure and reducing is dependency on the public purse.

4.4.67 Furthermore, while coverage targets are being met, it might be prudent to consider policies to limit potential overbuild of duplicate FTTP infrastructures in the same locations, whilst preserving the principles of vibrant infrastructure competition in the mid to longer term.

43 Sections 4.51 to 4.58 of the DCR discussion document

5 Review of fixed network functional separation

5.1 The options outlined by Ofcom

5.1.1 The DCR asks the following questions in relation to the review of the functional separation currently in place:

(1) Are there any actual or potential sources of discrimination that may undermine effective competition under the current model of functional separation? What is the evidence for such concerns?

(2) Are there wider concerns relating to good consumer outcomes that may suggest the need for a new regulatory approach to Openreach?

(3) Are there specific areas of the current Undertakings and functional separation that require amending in light of market developments since 2005?

(4) Could structural separation address any concerns identified more effectively than functional separation? What are the advantages and challenges associated with such an approach?

5.1.2 Further, the DCR lists the following options in relation to Ofcom's future approach to the regulation of BT:

A. **Continuation of our current approach**. "*We may conclude that the current strategic framework for regulation remains appropriate, and that any concerns which do arise can be fully addressed through the normal cycle of market reviews, or via existing dispute resolution mechanisms".*

B. **Strengthening the current model of functional separation**. "*Under this approach we would address any concerns with the current regulatory settlement, either by variations in the existing BT Undertakings, or by new regulatory conditions set within the European Framework".*

C. **Consideration of structural separation**. "*This has the potential to deliver benefits, since it would address BT's underlying incentive to discriminate against competitors, and enable a simplified regulatory framework. It may also increase Openreach's management focus on, and control over, network investment decisions and performance issues. However, to the extent those issues arise from a lack of competition to Openreach, it may not fully address them. It would be an intrusive and complex intervention both for BT and the rest of industry, with substantial implementation challenges. It would also require ongoing regulation to guard against excess returns by the structurally separate upstream 'monopolist'".*

D. **Substantial deregulation and greater reliance on end-to-end competition**. "*Access-based competition can be effective in promoting competition downstream of an access bottleneck, but is unlikely to drive improved performance in relation to the access bottleneck itself. Better performance by Openreach may therefore come through us encouraging a greater degree of direct end-to-end competition, by being more selective as to where and how we apply access remedies. However, this can result in increased costs, and therefore higher prices, if networks are duplicated. We have seen a variety of models internationally, delivering a range of different outcomes".*

5.1.3 The ultimate question is which of the above four models (A to D), or combination of models, will best meet consumer demands in terms of quality, choice and value.

5.1.4 The next consideration, assuming change is needed, is in what timeframe to effect the change? And what is the path from today's regulatory structure to the new regulatory structure? For example, Option D (Substantial deregulation and greater reliance on end-to-end competition), may delivery best outcomes for consumers over time, but it would be unrealistic to assume that this can happen immediately. So a timeframe and a path to get there must be considered.

5.1.5 Further, if there is to be a change to a new structure, Ofcom must ensure that the process to effect the change does not derail any progress underway, as this could damage or delay better consumer outcomes. For example, under Option C (Structural separation) Ofcom acknowledge that this would be *"an intrusive and complex intervention"* which could potentially paralyse decision making and investments during a lengthy process or restructuring.

5.1.6 There are without doubt competition issues in today's communications market, some of which arise directly from how BT is structured and/or regulated. For example, CityFibre wrote to Ofcom in the spring of 2015[44] about what we believe to be anticompetitive wholesale pricing strategies exercised by BT.

5.1.7 Whist CityFibre believes it remains possible to regulate BT in the current (or strengthened) framework of functional separation, it would require a clear strategy from Ofcom with well-articulated objectives to be effective, together with the commitment and resources to implement and realise these.

5.1.8 However, in relation to the 10-year period of this strategic review, it is important to consider what form of regulation should we be striving to obtain by the end of the review period, and what is the best approach to adopt to move towards that goal.

5.1.9 We strongly agree with Ofcom's opinion that "the best mechanism for delivering choice, quality and affordable prices is a healthy competitive market". Furthermore, we agree with Ofcom's view that "regulation works best when it is targeted where its needed, and removed where it is not"[45]. For this reason, CityFibre believes that Ofcom's Option D (Substantial deregulation and greater reliance on end-to-end competition) should be the longer-term objective. The broader question is how to get to this outcome efficiently?

5.1.10 If a greater level of end-to-end completion coupled with a light touch approach to regulation is the goal, Ofcom should consider if structural separation of BT can help achieve this more effectively than the the current (or strengthened) model for functional separation.

5.2 The three-layer competition model

5.2.1 As set out in more detail in section 4.3 above, CityFibre believes that Ofcom should structure their regulatory interventions to ensure that effective and efficient competition can be developed and sustained in each of the three layers: Passive, Active, and Service.

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44 Letter dated 4th March 2015 outlining concern of potential anti-competitive behaviour in Ethernet pricing.

45 DCR s. 1.12

5.2.2 As we stated in 4.3.13 above, CityFibre believes that investment and competition promoted at all three layers will deliver best consumer outcomes in terms of quality, choice and value. However, we acknowledge that today's market is biased towards Virgin's vertically integrated approach and Openreach's strategy to regain control of layer 2 through xDSL technologies. Together these provide limitations to innovation, investment and more effective competition.

5.2.3 Therefore, regulation must consider how to promote a model of effective competition at layer-1 passive infrastructure and also at layer-2 active wholesale; acknowledging that there maybe limited ability to intervene in the structure of Virgin Media's closed vertically integrated model.

5.2.4 CityFibre is building a passive only (layer 1) competitive open access wholesale infrastructure without a vertically integrated active network management business or a retail business. Our investment decisions are entirely governed by the needs of our wholesale customers and we have no conflict in our relationships with our customers as we do not compete with them in downstream active and retail layers.

5.2.5 It is our belief that this structure will provide the largest benefits to the market as other providers can innovate in layers 2 and 3, whilst CityFibre concentrates on ensuring that the physical network is designed to meet the needs of its customers.

5.2.6 A regulatory framework that promotes pro-competitive investment in open access layer-1 passive infrastructure (in particular with regard to the wholesale availability of dark fibre provided in competition to Openreach) will be a catalyst to evolve towards an effective three-layer competition model. This means ensuring that investments from CityFibre (and other wholesale passive infrastructure builders) should be encouraged to the highest extent possible.

5.2.7 Where open access passive FTTP networks are deployed, a vibrant competitive market at layer 2 active wholesale can be quickly established promoting innovation and choice towards consumers.

5.2.8 Putting aside the debate on forced structural separation, in an environment where significant FTTP investment is deployed by competitors to BT Openreach, it is our view that, over time, BT may become commercially incentivised to restructure its business into two – either layers 1 and 2 together with layer 3 separate, or layer 1 separate and layers 2 and 3 together. Presently BT Openreach operates in layers 1 and 2, as does BT Wholesale.

5.2.9 Furthermore, under the three-layer competition model, if would be beneficial for the layer-2 and layer-3 functions of BT's current businesses to operate independently of its infrastructure. For example, if an open access FTTP infrastructure is available to BT retail in an area where BT has not deployed FTTP, then BT should have the choice and ability to use that 3rd party infrastructure. This consideration should be extended to its wholesale operation too, especially to it EMP wholesale order management systems.

5.2.10 We understand that BT has circa 500 retail CPs integrated to its EMP wholesale platforms, that permit CPs to order and provision connections on BT's infrastructure only. We believe there may be significant benefits for pro-competitive infrastructure investment if BT's EMP was to be extended to enable ordering and provisioning on other networks; for example, on CityFibre's urban FTTP networks and Gigaclear's rural FTTP networks. We believe this could

be achieved either through a strengthened model of functional separation of through structural separation.

5.2.11 Imposing structural separation on BT is likely to be a long contentious process. During this process, the market would be characterised by uncertainty of whether, and if so how, BT would become structurally separated as well as how the new structurally separated unit would be regulated. The uncertainty would likely cause delays to investments in fibre infrastructure by both BT and its competitors. The impact of delays in investment are illustrated in Section 4.3.24 above.

5.3 How would structural separation be defined?

5.3.1 Whilst at a high level there are arguments that Openreach would be likely to behave more rationally (as an open access wholesale infrastructure provider) if it were structurally separated from the rest of BT, it is not at all clear how Ofcom would propose to define which part of BT should be structurally separated.

5.3.2 BT proposed in late 2014 to merge BT Wholesale into BT Openreach. Although CityFibre has received no recent updates on this subject, we consider it likely to still be under consideration.

5.3.3 There are thus two dimensions of uncertainty regarding how a structurally separated BT would look.

- Would the separated part cover only access networks or also long-distance transmission networks? And,
- Would the separated part be the passive layer 1 of the network only or also incorporate the active components at layer 2?

The impact on the market of each of the four potential options for structural separation above could differ substantially.

5.3.4 In relation to infrastructure competition, the intended market position of a structurally separated Openreach would need to be clearly defined. For example:

- Should a structurally separated Openreach be regulated to be an 'infrastructure monopoly' at layer 1 (and potentially layer 2)? We note Ofcom's view that a structurally separated Openreach "*would also require ongoing regulation to guard against excess returns by the structurally separate upstream 'monopolist' "*.
- Or, should a structurally separated Openreach compete at layer 1 (and potentially layer 2) with other providers?

5.3.5 Ofcom has acknowledged in the DCR, there now are a number of new infrastructure building CPs providing true end-to-end competition to Openreach[46]. Therefore, the above question is already answered. If Openreach was to be separated, it would continue to face an increasing end-to-end competition from cable and emerging providers of FTTP.

46 DCR s. 9.36, Figure 25

5.3.6 Therefore, creating a structurally separated Openreach as an 'infrastructure monopoly' would imply a foreclosure of competition, either forced (mandated buyback of infrastructure) or through a regulatory approach that sets wholesale access prices of the intended monopoly provider below prices that are achievable in the competitive market.

5.3.7 We refer Ofcom to CityFibre's BCMR response in Annex C, which details the problems of foreclosure in relation to the business connectivity market, that would result from Ofcom's proposals to regulate access to BT's dark fibre at costs based on a model (intended or non-intended) of monopoly supply by Openreach.

5.4 How would a structurally separated Openreach be regulated?

5.4.1 Of possibly more significance than whether BT were to be structurally separated, is how the separated entity would be regulated.

5.4.2 Again, we note Ofcom's comments that a structurally separated Openreach "*would also require ongoing regulation to guard against excess returns by the structurally separate upstream 'monopolist' ".* For the reasons stated above, CityFibre is strongly opposed to the suggestion that the structurally separated entity should be considered a monopoly supplier of infrastructure.

5.4.3 However, if the aim of the separation were to create an entity with which other infrastructure providers could compete (without the disruptive and sometimes perverse incentives BT Openreach is currently subject to, to assist BT's wholesale and retail businesses), then appropriate and well considered regulation could even the playing field for CityFibre and other investors in access networks. This would stimulate competition and investment at the passive level leading to innovation and better outcomes for consumers. This approach would require that the price levels of the separated entity are not regulated down to a level reflecting BT's current economies of scale, which no competing provider can match.

5.4.4 If the separated entity were to be subject to cost-oriented price regulation, based on BT's current unit cost levels (which reflect BT's significant economies of scale), then the structural separation would almost certainly result in a significant reduction in competition at the passive infrastructure layer.

5.4.5 Therefore, pro-competitive regulation in an environment of potential structural separation must still consider the need for appropriate economic space between the three layer of the competition model (Passive, Active and Services) and adopt an appropriate basis of evaluating the benchmark for unit costs such, as REO or MEEO, as we have detailed in section 4.4 above.

5.5 Considering excess profits

5.5.1 We note Ofcom's concern on the potential for 'excess profits' generated by Openreach, and this may be the case whether BT is separated or not. However, as competition develops and is increasingly able to challenge BT's offering, BT will not only be incentivised to invest more into FTTP, it will also lose market share. This will tend to drive BT's unit costs to eventual convergence with those of other infrastructure CPs, resulting in a competitive market and an ability to reduce the need for regulation.

5.5.2 In our letter to Ofcom of 28th April 2015 and in our BCMR response, we proposed that price floors should be established for BT's active/passive connectivity products, and that such price floors should be based on reasonable costs of an efficient new entrant operator. This approach would encourage infrastructure investment, but at the same time it will enable Openreach to continue to make accounting profits – which will reduce over time due to effects of infrastructure competition.

5.5.3 There will be opinion, from CPs that compete with BT at a retail level, that BT may use excess profits to cross-subsidise services in downstream competitive markets, and that this practice may be anti-competitive. Structural separation could be argued as a method of preventing profits from Openreach being used unfairly in BT's retail operations.

5.5.4 However, as Ofcom point out, the root cause of excess profits manifests irrespective of whether Openreach is a structurally separate entity. Therefore, Ofcom has a key decision to make:

- Adopt an approach that removes value from the infrastructure by regulating access pricing down to a level where excess profits, based on BT's current dominant scale economies, are removed; acknowledging that this would harm investment incentives for other CPs resulting in Openreach becoming a monopoly infrastructure supplier. Or,

- Adopt an approach to promote value in the infrastructure by setting regulated access pricing based on unit costs of a competitive market, which would allow Openreach to continue to make substantial profits for a period; acknowledging that such profits will reduce over time as greater levels of infrastructure competition are established.

5.5.5 It is CityFibre's opinion that adopting an approach which destroys value in the infrastructure would be inappropriate, as it is clear that significant infrastructure investment is needed and devaluing infrastructure at this juncture, and potentially foreclosing other infrastructure based CPs, will not delivery better consumer outcomes in terms of quality, choice and value.

5.5.6 We also believe that it is unlikely that cost savings to retail CPs, that result from a reduction in Openreach's wholesale access pricing, will be passed onto consumers. For example, we note that Ofcom is concerned that retail prices to consumers are constantly rising[47], often through increased line rental charges (which have increased circa 60% over the past 5 years), fuelling consumer opinion that major retail CPs are acting as a cartel[48]. Therefore, it could be argued that reductions at a wholesale access level leads to profit taking at a retail level.

5.5.7 Therefore, retaining value in the infrastructure and promoting competition and investment, is the direction that Ofcom must consider.

5.5.8 Furthermore, as stated above, the excess profit issue is likely to be time bound, and that the period of excess profits will coincide with a period when significant investment is needed to deliver FTTP. CityFibre suggests that Ofcom may wish to consider measures to encourage BT to deploy any excess profit towards improving and extending fibre infrastructure in the UK. This would give further benefits to the introduction of price floors for example, as the fibre infrastructure footprint would be extended by BT as well as by new entrant investment.

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47 As noted in a speech from Sharon White on 7th October 2015 to London School of Economics & Political Science

48 http://www.thisismoney.co.uk/money/comment/article-3269527/As-telecoms-providers-ramp-line-rental-costs-year-LEE-BOYCE-asks-regulator-Ofcom-going-it.html

5.5.9 BT's reported excess profit of circa £4Bn[49] has been made at the same time as BT receiving circa £2Bn of public subsidy via the BDUK programme to deliver super-fast broadband. Therefore, it seems clear that there must be stronger policies in place to ensure that BT is reinvesting excess profit into its infrastructure and reducing is dependency on the public purse.

5.5.10 Whilst there may be difficulties in establishing a direct and quantitative linkage between Openreach profits from current infrastructure and services, CityFibre suggests that Ofcom might consider adopting an approach whereby BT agrees with Ofcom and Government to provide a minimum level of incremental FTTP investment beyond the planned "business as usual" investments, with the level determined by an ex-ante assessment of the projected profitability of a future period.

5.5.11 Such 'excess profit' investment by Openreach should be in areas where the risks to the investment case may be high in the short term, and returns made in the medium to long term. These could include, for example:

- Expansion of FTTP to rural areas, i.e. to further than the 80% coverage estimated by CityFibre as achievable through commercial rollout, without the need for public subsidy.
- Delivery of a more ambitious and beneficial Universal Service Obligation (USO) by 2024 to ensure that all households have availability of affordable broadband of at least 30Mbit/s, i.e. beyond BT's current pledge of 5Mbit/s.

5.5.12 It would be expected that BT would collaborate with Ofcom, providing a proposed plan for such investments, with supporting information to justify that the investments fall within criteria defined by Ofcom. Ofcom would ensure that the agreed plan is implemented as a part of any revised regulatory framework.

5.5.13 CityFibre suggest that such an approach would offer substantial benefits to market players and end-consumers:

- Increased infrastructure investment leading to accelerated rollout of ultrafast FTTP services to businesses and consumers;
- Nurturing the development of new entrant players, leading to a multi-operator infrastructure market with healthy competition;
- Price stability for wholesale products for a defined period, allowing the market to develop in a controlled and stable manner and giving investor confidence over the medium term.

5.6 Conclusions

5.6.1 CityFibre believes that the primary objective of Ofcom's review should be to establish a regulatory environment that delivers to consumer needs (business public sector and residential) through ensuring that pro-competitive investments in FTTP deployments are accelerated from early 2016. Only when significant FTTP infrastructure build is underway should structural separation be considered.

49 Sections 4.51 to 4.58 of the DCR discussion document

5.6.2 This would allow time for a form of structural separation to be defined and a period of stakeholder consultation conducted, potential in parallel with strategies to extend FTTP delivery beyond 80% target coverage.

Annex A: The benefits of infrastructure competition

A1.1 This Annex presents academic and empirical evidence that supports the significant additional benefits arising from infrastructure competition, relative to the benefits available for service competition only. We also present evidence on the impact of service development and quality of service outcomes in markets characterised by infrastructure competition compared to service competition

A1.2 Academic evidence

1.2.1 The advantages of infrastructure competition between independent providers over service-level competition (where Communications Providers access the network provided by a dominant owner of an essential input) have long been recognised by academic and other researchers.

1.2.2 Many academic studies have explored the relative benefits of infrastructure-, or facilities-, based competition compared with service-based entry. For example, as Glen Woroch explained in 1998: *"… entry by facilities based competitors … is seen as a particularly effective means to support the efficient capital investment and adoption of advanced technologies."*[50] Woroch also says that *"vigorous competition among network owners is also believed to safeguard consumers against incumbents' attempts to extend their monopoly power into adjacent markets"*[51] . This is an important benefit of infrastructure competition where the incumbent operator has SMP in the upstream, wholesale market.

1.2.3 More recently, Johannes Bauer suggests that the benefits of infrastructure competition include innovation and investment *"as well as the associated longer term user benefits"*[52] . Similarly Martin Cave suggests that an over-reliance on service-based competition would deny consumers the benefits of infrastructure competition[53] .

1.2.4 One of the key features of any market where a vertically integrated firm is dominant upstream but faces competition downstream is that the firm can leverage its dominance into the downstream market, as suggested by Woroch. The presence of independent competition makes this much more difficult, if not impossible. A major contributing factor to BT's investment in its own infrastructure has been the development of large-scale infrastructure competition, via cable network investment, now operated by Virgin Media. In a 2012 paper, Nardotto, Valletti and Verboven[54] use data sets for the UK on broadband penetration and speeds to analyse the impact of inter-platform competition (cable networks vs. traditional telecoms providers) and intra-platform competition (whereby entrants access BT's network). They find that intra-platform competition through LLU entry has not significantly raised total broadband penetration. In contrast, inter-platform competition (between networks) has had

50 Woroch, G. 'Facilities Competition and Local Network Investment: Theory, Evidence and Policy Implications' in Industrial and Corporate Change Vol. 7 No. 4 1998 pp601 - 614

51 op cit, footnote 11

52 Bauer, J. 'Regulation, Public Policy and investment in communications infrastructure' in Telecommunications Policy Vol. 34, 2010 pp. 65 - 79

53 Cave, M. 'Encouraging infrastructure competition via the ladder of investment' in Telecommunications Policy Vol. 30, 2006 pp223 - 237

54 Mattia Nardotto, Tommaso Valletti and Frank Verboven; Unbundling the Incumbent: Evidence from UK Broadband. Centre for Economic Policy Research, Discussion Paper No. 914, October 2012.

a more significant impact and *"always leads to market expansion"*[55]. LLU has had a positive impact on the quality of service provided, but infrastructure competition has a positive impact on both penetration and quality. This is one reason why competition based on passive access should not be referred to as infrastructure competition.

1.2.5 Similarly, Bouckaert, van Dijk and Verboven (2010)[56] analysed the effects in the broadband market of, what they referred to as: a) inter-platform (facilities-based or infrastructure) competition; b) facilities-based intra-platform (LLU) competition; and c) service-based intra-platform competition. Using a sample of OECD countries, they found that inter-platform competition has been the main driver of broadband penetration and that the two types of intra-platform competition have a *"considerably smaller effect on the broadband penetration"*.

1.2.6 The final two papers cited above refer to competition between the incumbent's copper and the entrant's cable network. However, there is no reason to think that these findings would not apply to different networks of the same type, i.e. between independent fibre networks. The benefits come from independent entities competing to provide broadband products to customers. How this is achieved from a technical standpoint is not important. What is important is that independent rivals can compete across all levels of the value chain including, for example, network design and topology.

A1.3 Empirical evidence

1.3.1 Empirical evidence of the positive effects of competition between independent networks can most clearly be illustrated using data from broadband markets where competition is between copper and cable. However, again, it is our view that these lessons apply equally to business services offered on the same network type but by different operators. In essence, where there is competition between different networks, whether they use the same technology or not, then customer outcomes are superior to where competitors all use the same network. The networks become involved in a competitive "arms race" to offer better service levels than their rivals and whether one is copper and one is cable, or both are fibre, is not important.

1.3.2 Another significant advantage of infrastructure competition over service-level competition is that it causes the incumbent to invest and innovate at the deepest level of its network. The use of passive access remedies gives competitors the opportunity to compete in providing the active elements of the network, but does not provide competition at the final infrastructure level. BT is therefore under no competitive pressure to expand its infrastructure to more premises, improve the efficiency of its infrastructure or lower its infrastructure build costs.

A1.4 Infrastructure competition and product benefits

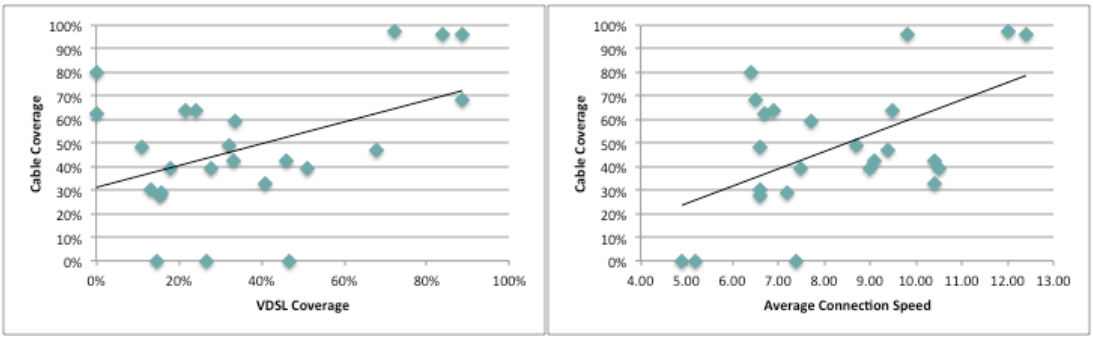
1.4.1 The positive effect on consumer outcomes of competition between independent service providers is most clearly seen in the European broadband markets. Figure 1 illustrates a strong correlation between the presence of cable infrastructure and both the presence of VDSL and increased broadband access speeds. The left hand panel shows the correlation between cable

55 op cit, p.28

56 Jan Bouckaert, Theon van Dijk, FrankVerboven; Access regulation, competition, and broadband penetration: An international study. Telecommunications Policy 34 (2010) pp 661 – 671.

and VDSL coverage and the right hand panel between cable coverage and average connection speed. The markers in each graph represent different European countries.

Figure 1: Correlations between Cable and Speed and Cable and DSL



Source: European Commission , Akamai, SPC Network

1.4.2 Investment in VDSL is positively associated with the presence of cable networks. The right hand panel shows an even stronger correlation between the coverage of cable and the average connection speed enjoyed by consumers. The two countries with the highest broadband access speeds in Europe (the Netherlands and Switzerland) also have nearly 100% cable and over 70% DSL coverage. As always it should be remembered that correlation does not mean a cause and effect, but it is clear that two technologies from separate firms tend to go together and access speeds are higher where cable is present. A reasonable interpretation of this correlation is that investors in cable and VDSL have responded to the presence of each other through investing more in their own technology.

1.4.3 Such an interpretation is supported by the findings of a report by Bain & Company in 2009, which noted:

In European markets where a second wireline access infrastructure is widely available (most frequently cable in residential households), telecom and cable operators are increasingly competing in one another's traditional markets. This competition is also spurring momentum for the upgrade of wireline networks, pushing them to provide higher broadband speeds. In countries such as the Netherlands, Belgium and Switzerland which have two competing fixed infrastructures covering more than 80 per cent of the population, consumers already experience higher average broadband speeds of 5.3 Mbit/s compared with 4.0 Mbit/s in other Western European markets. In addition, in these three countries broadband penetration is at 32 per cent of the population compared with 25 per cent in other Western European countries.

This comment is at least as true today as it was in 2009, although the average speeds and household broadband penetration are substantially higher today.

A1.5 Infrastructure Competition and Quality of Service

1.5.1 Infrastructure competition allows for substantially different quality of service (QOS) performance between platforms. If all CPs used the same network then they would all have similar QOS levels simply because the underlying network is the same. Where there are competing networks then the network providers can offer different service levels.

1.5.2 Ofcom complaints data illustrates the difference in quality offered by different networks. The data shows that Virgin Media, which does not use the BT network, has been consistently the

best performing broadband supplier with complaints per 1,000 customers some one third of the industry average. Service providers using the BT network are to some extent limited by the QOS offered by BT Openreach. However, an independent competitor is able to offer substantially different quality of service because it is not dependent on BT: a feature that would be the same regardless of the network type involved.

1.5.3 Additionally, the existence of alternative infrastructures with a high fibre count, offers products and quality of service differentiation that BT alone cannot provide.

A1.6 *Conclusions on the advantages of infrastructure competition over service competition*

1.6.1 From the studies shown, it is clear that independent access infrastructure providers competing with BT of their own accord would be superior to service-level competition, even if that service-level reached as deep as the dark fibre network. Without the incentive to invest in its base infrastructure, dark fibre access would provide no incentive to BT to expand its network as competition would only be present in the areas where BT's network already reaches.

1.6.2 The crux of this argument is that whilst infrastructure competition leads to significantly improved outcomes for consumers, it requires that alternative providers make the decision to invest and actually build competing networks.

Annex B: CityFibre's BCMR submission

Please see attached file titled "CityFibre BCMR LLCC Response 7th August 2015 – Non-Confidential Version"

--- END OF RESPONSE ---