Response to Ofcom's Consultation on:

Promoting investment and competition in fibre networks

Initial consultation on the approach to modelling the cost of a fibre network.

by the
Infrastructure Investors Group

CityFibre eunetworks

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Response compiled by GOS Consulting Limited

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1 Introduction

1.1.1 The IIG welcomes Ofcom's initiative to build a network to calculate costs of a fibre network. The IIG members invest in and build new fibre networks in the UK to serve residential and business users, with different business models including a wholesale-only model.

1.1.2 The IIG has consistently asked Ofcom to build a costing model to assess the costs of a reasonably efficient operator (REO), so that Ofcom can understand the consequences of its regulation of BT prices on investors in competitive fibre networks. So, Ofcom's clearly stated intention to model both the costs for BT to deploy new fibre networks and for REOs to deploy new fibre networks is particularly welcome.

1.1.3 Some individual members of the IIG have undertaken detailed analysis of Ofcom's proposed model and modelling approach and this response is based on the collective understanding of Ofcom's proposals across the IIG members.

1.1.4 Whilst welcoming Ofcom's move to calculate the costs of building fibre networks, the IIG members have strong concerns with a number of aspects of the draft model accompanying the consultation document as well as with specific proposals in the consultation document. We set those concerns out in the response and also refer Ofcom to the relevant individual responses made by IIG members.

2 The Infrastructure Investors Group

2.1.1 The Infrastructure Investors Group (IIG) is a collective of alternative infrastructure providers who have built, own and operate high-speed electronic communications networks within the UK, independently of BT. Whilst the members of the IIG normally compete intensely with each other, they believe that it is important to present a strong voice to protect a pro-investment environment for electronic communications networks in the UK and have come together for this sole purpose.

2.1.2 The members of the IIG are (in alphabetical order):

- CityFibre Infrastructure Holdings plc
- euNetworks Group Limited
- Zayo Group UK Limited

2.2 CityFibre Holdings

2.2.1 CityFibre is the UK's largest alternative provider of wholesale fibre network infrastructure. It has major metro footprints in 51 cities across the UK and a national long-distance network that connects these cities to major data-centres across the UK and to key peering points in London. The company has an extensive customer base spanning service integrators, enterprise and consumer service providers and mobile operators. CityFibre provides a portfolio of active and dark fibre services. CityFibre currently operates in excess of 2,250 kilometres of metro local access duct, as well as 1,139 kilometres national long-distance network connecting 22 towns and cities to data centres in London and the UK regions. In July 2016, CityFibre raised a further £200m in order to commence construction of FTTP across our towns and cities and to expand our networks into further towns and cities, regulatory conditions permitting. In November 2017, CityFibre announced a Strategic Partnership with Vodafone to commence construction of FTTP to 1 million premises, potentially expanding to 5 million premises if regulatory conditions permit. In November 2018, following the acquisition of CityFibre by a consortium of Antin Infrastructure Partners and West Street Infrastructure Partners (a subsidiary of Goldman Sachs), CityFibre announced firm plans to expand its full fibre network to 37 named towns and cities by 2024.

2.2.2 CityFibre's commercial model consists of densifying the core rings, deployed to deliver business grade fibre services for the aforementioned enterprise and consumer service providers, and using these to deliver full fibre services. As such therefore the consequence of these investment decisions will be affect all segments of the vertical .

2.3 euNetworks

2.3.1 euNetworks is a Western European provider of bandwidth infrastructure services. euNetworks focuses on delivering scalable, fibre based products and solutions to a customer base that is at the centre of technology transformation. euNetworks' customers require fibre-based data centre to data centre connectivity, both within the key cities in Europe and between these cities, supporting both their bandwidth growth and the performance requirements that their applications demand. euNetworks owns and operate 14 dense fibre based metropolitan city networks. These are connected with an intercity backbone covering 49 cities in 15 countries.

euNetworks leads the market in data centre connectivity, directly connecting over 370 in Europe today, with further data centres indirectly connected.

2.4 Zayo Group

2.4.1 Zayo Group Holdings, Inc. (NYSE: ZAYO) provides mission-critical bandwidth to the world's most impactful companies, fuelling the innovations that are transforming our society. Zayo's 133,000-mile network in North America and Europe includes extensive metro connectivity to thousands of buildings and data centres. Zayo's communications infrastructure solutions include dark fibre, private data networks, wavelengths, Ethernet, dedicated internet access and data centre colocation services. Zayo owns and operates a Tier 1 IP backbone and 51 carrier-neutral data centres. Through its CloudLink service, Zayo provides low-latency private connectivity that attaches enterprises to their public cloud environments. Zayo serves wireless and wireline carriers, media, tech, content, finance, healthcare and other large enterprises. For more information, visit zayo.com.

3 Ofcom's overall approach to modelling the costs of fibre networks

3.1.1 Ofcom proposes a modular structure for the model and has commissioned some of those modules to be built by Cartesian. The IIG has the following concerns:

- Some of the modules of the model are large, and when all modules are linked together the model runs slowly and crashes frequently (even on a high-performance laptop with 32G of memory running 64-bit excel). This may be a result of complex sets of links between modules, often referring to large arrays, which can be very memory-intensive.

- Ofcom seems to have adapted some modules from previous models, which were used to set charge controls, which are not necessarily well suited to this type of model. For example, the cost recovery is performed on a year-by-year basis, using economic depreciation; in order to assess investment incentives, it would be helpful to consider the network deployments from the point of view of a potential investor, who would typically look at the achievable IRR using a DCF analysis.

- There is no robust demand analysis included in the model. The volumes module takes Openreach volumes and numbers of premises and applies some high-level assumptions, but a rigorous assessment of the viability of network rollout requires a more dynamic approach whereby revenues and demand are modelled explicitly.

- There is only one network infrastructure module and it reflects BT's network architecture (tree and branch). There is no way to model the costs of building a modern state-of-the art network, which would be based on ring as well as tree and branch structures. We would expect that a scorched-earth approach to network deployment would include such an approach, whether or not DPA is used. However, the scorched-earth option in the model does not achieve this, as it only allows the locations of exchanges and cabinets to be optimised, within the same tree-and-branch structure.

- The geospatial analysis is detailed, and provides an appropriate assessment of costs (for a tree and branch network) at the postcode sector level. However, the model does not attempt to cluster these postcodes into discrete settlements (cities, towns or villages) before determining the deployment sequence. As a result, the modelled deployment can be highly fragmented, covering partial sections of many towns.

4 Comments on proposals and options covered in the consultation document

4.1.1 Ofcom consults on the following categories of issues:

- Ofcom's approach to modelling fibre network costs;
- Ofcom's approach to forecasting service volumes;
- Ofcom's approach to network dimensioning and costing; and
- Ofcom's approach to cost recovery.

4.1.2 We address each of these topics in turn below.

4.2 Ofcom's approach to modelling fibre network costs

Services and network scope

4.2.1 Ofcom proposes to build a bottom-up model. The IIG agrees with this approach, as there is no existing national fibre network in the UK and, in any case, Ofcom's model should consider the costs of building fibre networks by market entrants, as well as than by the established incumbent.

4.2.2 Ofcom proposes to base the model on BT's existing service portfolio. Whilst that is a practical starting point, the IIG is concerned that BT's existing portfolio is provided on a hybrid fibre copper network and it is also unlikely that a REO will offer the same portfolio of services as BT.

4.2.3 Whilst it is possible to set volumes for some services to zero (and thus none of the service specific costs for that particular service will be included in the cost calculations), it does not seem that the model can accommodate services that a REO may offer, but which BT does not offer. It is difficult to anticipate the new products that will be offered across fibre networks for the next 40 years, but we believe that Ofcom should issue an explicit request to CPs to provide information about products they plan to offer and which would not be accommodated under the BT service portfolio categories.

4.2.4 Ofcom proposes that the model should cover the segment from the Access Node to the customer premises and between the access node and the Aggregation node. Whilst the IIG agrees that this in principle covers the access network, the specification of these elements shows that Ofcom is planning to model a network that mirrors BT's current network architecture. The IIG does not consider it appropriate that a model to assess costs of a new modern fibre network should be reflect the architecture of a historic copper network that has evolved over many years.

4.2.5 Modern resilient networks are based on ring configurations and build in capacity to meet forecast demand, whereas it seems that Ofcom's model is dimensioned to meet FTTP demand only and that all other demand is considered incremental. That is not how a new modern network would

be designed and dimensioned and the IIG considers this an inappropriate approach for Ofcom to take.

Deploying networks in different geographic areas and at different scales.

4.2.6 Ofcom proposes to model the costs at the postcode sector level and to enable cost calculations at different scales. The IIG agrees with these points in principle, but when reviewing the actual model accompanying the consultation document, it is clear that while the model does allow CPs to vary the scale of deployment, this is done purely on a volume basis; as the scale is reduced, postcode sectors are removed, leaving behind a set of postcodes which may be geographically separated, rather than clustered into cities, towns and villages. This is not an accurate reflection of real-world network deployments.

4.2.7 IIG members have widely differing business models and their networks are in different locations and at different scales. None of the networks operated or planned by the IIG members could be modelled using Ofcom's proposed approach. The IIG considers that to deliver on its intention to enable cost assessment at different scales and geographies, the model should allow CPs to select specific towns/geographic locations for the network to cover.

4.2.8 Ofcom's model offers scorched node and scorched earth modelling approaches. The IIG was pleased to see that Ofcom had allowed for a scorched earth approach, as this would enable to costing of a modern resilient network. Upon review of the model, however, it became apparent that the scorched earth approach is not what is commonly understood by that term. Typically, scorched earth would refer to a greenfield network design where it is assumed that modern up-to-date design and equipment is deployed. The option in Ofcom's model, however, simply allows for optimisation of where exchanges and cabinets are located, nothing more.

4.2.9 This means that the network costed is BT's old historic network design, not that of a modern resilient network based on ring configurations. The IIG considers this approach to be highly inappropriate and urges Ofcom to commission a network infrastructure module that can cost a modern network. Any one-off adjustment to up-front costs would not be a solution, as the service provisioning costs in different network designs are very different.

4.2.10 Ofcom assumes that a network reuses existing physical infrastructure (using BT's PIA service) to the maximum level that it is available. One IIG member (CityFibre) is currently attempting to use existing physical infrastructure for scale deployment of FTTP networks. Its experience is that the product is not fit for scale deployment and savings are not as expected, due to the need to undertake a significant amount of repairs to BT's infrastructure and/or re-route the network to circumvent issues in the existing infrastructure. This is costly and slows down network deployment.

4.2.11 Further, even if the reuse of existing infrastructure would offer significant benefits in terms of saving costs and/or time, it would not be possible to use it everywhere in the new network without compromising on the resilience and capacity of the network design.

4.2.12 The IIG therefore urges Ofcom to reduce the assumed reuse of existing physical infrastructure.

Model structure

4.2.13 Ofcom has commissioned work by Cartesian to develop three of the model modules, namely the network module (comprising network dimensioning and costing), the infrastructure module (calculating the quantities of underground infrastructure) and the Geospatial analysis (which is not provided as part of the model). The remainder of the model modules have been developed in-house by Ofcom.

4.2.14 The IIG considers that, whilst the model structure may be useful for setting annual costs/prices. It is not a model structure that would typically be used by investors in new networks, so it will not be easy to compare outputs.

4.2.15 The IIG encourages Ofcom to add a module that calculates the npv of the investments made and that also incorporates a comprehensive demand analysis with revenue streams assigned. Prices can be set at cost (including WACC), so that should not present a problem. Including revenues would enable a discounted cashflow analysis, which would typically be part of an investment assessment.

4.2.16 Additionally, the IIG has not found the model to be structured in a user-friendly manner. The model runs very slowly and crashes frequently, even when run on a top spec computer (i7 processor, 32G memory, 64-bit excel). Also, whilst the model has switches for Ofcom's pre-set scenarios, other standard variables that a CP would want to vary (such as the penetration level of the provider) are buried in the model and not easy to navigate.

Approach to model calibration / cost verification

4.2.17 Ofcom proposes to calibrate/verify the model inputs and outputs using data from CPs as well as other data available including models developed by other sector regulators.

4.2.18 The IIG agrees that it is important that the model is calibrated and validated, but, as mentioned above, the type of model proposed by Ofcom would not generate the same types of output as models developed by CPs for investment and business planning purposes. If Ofcom adds a module that calculates npv of costs and a dcf, then it will become more meaningful to compare CP models with Ofcom's model.

4.2.19 Models developed by other regulators may be useful as reference points, but the IIG cautions against over-reliance on such models as the costs of network deployment can vary substantially between countries.

4.3 Ofcom's approach to service volume forecasting

FTTP and Leased Lines

4.3.1 Ofcom predicts FTTP demand based on household counts and estimates leased lines demand as a function of the FTTP demand. The model allows for up to 10 different FTTP deployment scenarios to be specified, but these do not allow the leased line deployment to be adjusted independently.

4.3.2 The IIG considers that the model should have the flexibility for a CP to be able to specify its own scenario and that such a scenario should be able to reflect a leased lines only business model as well as a mixed business model and a model for FTTP deployment only.

4.3.3 The IIG agrees with Ofcom that it is important that the model can reflect a number of different deployment scenarios, but is simply concerned that the model is not sufficiently transparent for a CP to be able to fully understand how each scenario is defined and what the consequences are of the scenarios. At present the model is populated by placeholder data, so it is not even possible for CPs to compare the different scenarios specified in the model at present, as the outputs are counter-intuitive and it is clear that there are other issues in the model in addition to the input data not being correct.

4.3.4 The IIG considers that Ofcom should undertake a full demand forecasting process. The model spans a 40 year period, but it is assumed that 10G remains the highest speed leased line service. There is no provision for capacity requirements for 5G and other relatively near-term development including self-driving cars. Simply setting leased lines demand as a fraction of FTTP premises served reflects a static relationship between the two services which is unlikely to prevail.

4.3.5 The IIG is concerned that the network costed by Ofcom, using its proposed volume forecasting, will be under-dimensioned and therefore under-costed. Reliance on such a model could cause further harm to investment incentives in the UK, over and beyond that already incurred by Ofcom's very aggressive downward price regulation for both leased lines and broadband services in the UK. This could, in the longer term, have a detrimental effect on the efficiency of the networks deployed, and their ability to provide adequate capacity to meet future demands.

DPA and Dark Fibre

4.3.6 The IIG believes that it is unlikely that a competitive CP will provide DPA at any significant scale.

4.3.7 Dark fibre, however, is a commercial product provided by all IIG members and it is important that it is included in the model in a transparent manner. The IIG notes the ability to set the proportion of dark fibre provided. It is assumed that is as a proportion of leased lines volumes. If so then that is considered acceptable by the IIG, although it would be preferable if dark fibre were a separate product group so that the demand characteristics for the product could be set independently of those for leased lines

Relationships between rentals and ancillary services

4.3.8 The IIG has no comments on this aspect of Ofcom's proposals, but may wish to comment at a later stage.

Consolidation of services

4.3.9 The IIG has no comments on this aspect of Ofcom's proposals, but may wish to comment at a later stage.

4.4 Ofcom's approach to network dimensioning and costing

Network dimensioning

4.4.1 The IIG understands that Ofcom proposes to dimension the network for FTTP demand only and that all leased lines capacity will be added incrementally as demand develops.

4.4.2 For FTTP, the model assumes that the lowest cost postcode sectors are addressed first. The IIG is concerned at this approach. Network deployment is not done like this in real life and it is not clear what the consequences of this approach are on the model outputs.

4.4.3 For example, the lowest cost postcode sectors are likely to be spread across a number of towns and cities in the UK, but a CP will typically address one town holistically, rather than to cherry-pick low cost postcode sectors across the country. That approach would simply not be realistic from neither a commercial deployment nor a construction crew management perspective.

4.4.4 Additionally, some low cost deployment postcode sectors may represent very low commercial revenue potential, so it is not correct to assume that low cost locations will always be prioritised by a CP building new fibre networks.

4.4.5 It is not possible to see the impact of this assumption in the model, but the IIG urges Ofcom to change this assumption in favour of one that addresses towns more holistically.

4.4.6 Ofcom assumes that each new leased line results in the addition of new fibres in the network. Whilst some providers use separate fibre cables each leased line, the IIG does not agree that the network should not be pre-dimensioned to cater for an expected level of leased lines provision.

4.4.7 IIG members all provide leased lines, both as active leased lines and as dark fibre. The networks constructed are based on dense metro rings with sufficient capacity to meet foreseeable demand. It would not be good engineering and operational practice to have to insert new fibre cables for each new leased line connection.

4.4.8 The approach proposed by Ofcom appears to be a consequence of the model using the old-fashioned tree and branch network topology and also of a decision to only dimension the network to meet FTTP needs. The IIG disagrees with this approach.

4.4.9 Ofcom determines the amount of new physical infrastructure by assuming that all existing physical infrastructure is used before new infrastructure is built. The IIG members are keen to use existing physical infrastructure where this is technically and commercially viable, but there are parts of the network where it would compromise the network topology if it was entirely based on existing physical infrastructure.

4.4.10 In any case, the IIG considers it inappropriate for Ofcom's model to assume that a provider will always use existing physical infrastructure if it is available; a CP will typically perform a build-buy assessment in each case, and only use DPA if it provides the most effective approach.

Network Costing

4.4.11 The capex calculations are based on a set of network elements, for which inputs define current prices and price trends over 40 years, and a calculation of network element volumes, which is partly driven by the geospatial analysis.

4.4.12 There is a problem with the application of a constant price trend to certain network elements; for example, the price of 10G NTEs is currently very high compared to 1G NTEs, but the price is likely to decline rapidly over time, and then level out to a level similar to the current 1G price. The model structure does not allow for such a price profile, only a constant annual reduction.

4.4.13 Ofcom groups a significant number of opex categories together and assumes that they are a fixed proportion of the Gross Replacement Cost of the underlying network assets. It is not unusual for bottom-up models to assume that opex is a percentage of capex, but the IIG considers that Ofcom's model needs to recognise that the opex percentage is likely to vary with the scale of the network deployment.

4.4.14 The model assumes that the provider starts with zero connections and gradually builds up coverage and penetration. It would be reasonable to assume that the opex percentage would vary both over time and depending on the size of the deployment. As Ofcom has a stated objective of understanding the costs of fibre network deployment at different scales and speed, the IIG considers that the model needs to be able to reflect the different levels of opex for such different scenarios.

4.5 Ofcom's proposed approach to cost recovery

Depreciation approaches

4.5.1 Ofcom presents three different depreciation approaches and does not express preference for one in particular, stating that it will consult on its preferred approach later this year. The options presented are economic depreciation, simplified economic depreciation, and current cost accounting.

4.5.2 The model as presented with the consultation document cannot provide sensible assessment of the different depreciation scenarios, as the input price trend data provided is not reasonable (for example, fibre cables and NTE equipment have strong nominal price declines). Such trends have a large impact on the recovery profiles in the three depreciation methods, and until these inputs are robust it is not possible to compare the methods with any confidence.

4.5.3 When selecting a depreciation approach, consideration should be given to the desired output. If Ofcom intends the outputs from the model to have a significant role in determining the level of maximum and minimum prices in the market, then it may be most appropriate to select an option that produces the most stable and flat unit cost outputs. The IIG looks forward to reviewing and responding to Ofcom's consultation on this matter later this year.

4.5.4 As mentioned earlier in this response, the IIG understands that Ofcom wishes the model to provide annual unit costs and therefore needs to structure the model to do this, including the use of depreciation. The IIG considers that the model should also calculate the npv of the costs

of the network and a dcf assuming that prices are set at cost including a reasonable level of return. Although a dcf calculation does not directly produce annual service costs, it has the benefit of allowing different revenue/pricing scenarios to be assessed (for example, based on market considerations) against the costs and the required returns on the investments.

4.6 Assessment duration

4.6.1 Ofcom proposes that the model should cover a 40 year period. The IIG has no objection to this in principle but wishes to understand from which point the model assumes a 'steady state'. As set out earlier in this response, the IIG is concerned that Ofcom's demand forecasts are not appropriate as they exclude foreseeable demands which would have a significant impact on the type of network required and on the resulting unit costs.

4.7 Cost of capital

4.7.1 The IIG looks forward to responding to Ofcom's consultation on the appropriate WACC. When developing its proposals for the WACC(s) to apply in the model, it is important that Ofcom recognises it is unlikely to be appropriate to use the same WACC for BT as for REOs.

4.8 Shared Costs

4.8.1 A very large portion of the costs in the model have been categorised as shared costs and of those costs the category named cross service group costs (primarily duct costs) is by far the largest. The cross service group costs represents more than 60% of the total costs in the model.

4.8.2 Ofcom proposes that all shared costs should be recovered through a mark-up to direct LRIC costs of each service and describes three different options for recovery of shard costs being: equi-proportionate mark-up (EPMU), volume-based allocation, and value-based allocation.

4.8.3 Ofcom does not express a preference for either of the mark-up approaches and it is not clear whether Ofcom is proposing that they will all be used at different levels of distribution between service groups and within service groups.

4.8.4 The IIG considers that it is inappropriate to use a general mark-up approach for the allocation of such a large portion of total costs. It is possible to generate cost allocation approaches using cost causality as a principle to do this to ensure that costs are distributed more fairly and reasonably.

4.8.5 As an example, if EMPU was used to distribute duct costs between active leased lines and dark fibre, the active leased line would attract much more duct costs than the dark fibre, due to the terminal equipment LRIC costs for the active leased line. This level of allocation could however be done more fairly using the volume-based allocation.

4.8.6 Allocation of duct costs between the three main service groups (FTTP, leased lines, and DPA) could, for example be done using the fibre count allocated to each service. For this to work, it would be necessary to assign a fibre count to the DPA service, but that would be relatively straight forward.

4.8.7 Ofcom makes no proposals for which mark-up approaches should be used at different levels, so it is difficult for the IIG to provide more inputs than as set out above. The IIG looks forward to

engaging with Ofcom in the next consultation on this model, as regards the detailed shared cost attribution methods that would be most appropriate.

5 Comments on the model provided

5.1.1 Ofcom has stated clearly that the model is provided for the purpose of communications providers (CPs) conducting scenario analyses, but that the outputs produced by the model at the moment are not indicative of the outputs that will be produced once the model has been populated with the actual data rather than the current placeholder data.

5.1.2 Based on the analysis undertaken by IIG members, however it has become clear that when changing basic input assumptions such as the penetration level of the operator network being costed, the model produces counter-intuitive results. An example of this is that when modelling the total costs of deploying a network and achieving 100%, 50% and 33% penetration, the total costs for 50% and 33% are higher than the total costs for 100%. It has not been possible so far to understand what causes this to happen, as the model is not sufficiently transparent to make it possible to trace the difference caused by changing a change to an input.

5.1.3 Additionally, the model only allows for the assessment of the pre-defined scenarios built into the model. CPs need to be able to reflect specific business models, but that is not accommodated by the model. This means that Ofcom will not be able to understand the costs of the different types of network providers in the UK, and thus cannot understand the impact on those network operators of Ofcom's regulation of BT's prices. For example, some IIG members offer leased lines only and others offer a mixture of FTTP and leased lines, but the model assumes that leased lines take-up is a percentage of FTTP take-up. Using that assumption, providers offering leased lines only simply cannot use the model to calculate their network and service costs.