Hull Area Wholesale Fixed Telecoms Market Review 2021-26

Annexes 1-9

Non-confidential version – redacted for publication [✂]

CONSULTATION:

Publication date: 16 July 2020

Closing date for responses: 24 September 2020

Contents

Annex

A1. Responding to this consultation

How to respond

A1.1 Ofcom would like to receive views and comments on the issues raised in this document by 5pm on 24 September 2020.

A1.2 You can download a response form from https://www.ofcom.org.uk/consultations-and-statements/category-1/2021-26-hull-area-wholesale-fixed-telecoms-market-review. You can return this by email to the address provided in the response form.

A1.3 If your response is a large file, or has supporting charts, tables or other data, please email it to hull.review2021@ofcom.org.uk, as an attachment in Microsoft Word format, together with the cover sheet. This email address is for this consultation only, and will not be valid after 30 September 2020.

A1.4 We welcome responses in formats other than print, for example an audio recording or a British Sign Language video. To respond in BSL:

- Send us a recording of you signing your response. This should be no longer than 5 minutes. Suitable file formats are DVDs, wmv or QuickTime files. Or
- Upload a video of you signing your response directly to YouTube (or another hosting site) and send us the link.

A1.5 We will publish a transcript of any audio or video responses we receive (unless your response is confidential).

A1.6 We do not need a paper copy of your response as well as an electronic version. We will acknowledge receipt if your response is submitted via the online web form, but not otherwise.

A1.7 You do not have to answer all the questions in the consultation if you do not have a view; a short response on just one point is fine. We also welcome joint responses.

A1.8 It would be helpful if your response could include direct answers to the questions asked in the consultation document. The questions are listed at Annex 4. It would also help if you could explain why you hold your views, and what you think the effect of Ofcom's proposals would be.

A1.9 If you want to discuss the issues and questions raised in this consultation, please contact Lucy Cass on 0131 226 8109, or by email to Lucy.Cass@ofcom.org.uk.

Confidentiality

A1.10 Consultations are more effective if we publish the responses before the consultation period closes. In particular, this can help people and organisations with limited resources or familiarity with the issues to respond in a more informed way. So, in the interests of transparency and good regulatory practice, and because we believe it is important that

everyone who is interested in an issue can see other respondents' views, we usually publish all responses on the Ofcom website as soon as we receive them.

A1.11 If you think your response should be kept confidential, please specify which part(s) this applies to, and explain why. Please send any confidential sections as a separate annex. If you want your name, address, other contact details or job title to remain confidential, please provide them only in the cover sheet, so that we don't have to edit your response.

A1.12 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and try to respect it. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A1.13 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's intellectual property rights are explained further in our Terms of Use.

Next steps

A1.14 Following this consultation period, Ofcom plans to publish a statement in April 2021.

A1.15 If you wish, you can register to receive mail updates alerting you to new Ofcom publications.

Ofcom's consultation processes

A1.16 Ofcom aims to make responding to a consultation as easy as possible. For more information, please see our consultation principles in Annex 2.

A1.17 If you have any comments or suggestions on how we manage our consultations, please email us at consult@ofcom.org.uk. We particularly welcome ideas on how Ofcom could more effectively seek the views of groups or individuals, such as small businesses and residential consumers, who are less likely to give their opinions through a formal consultation.

A1.18 If you would like to discuss these issues, or Ofcom's consultation processes more generally, please contact the corporation secretary:

Email: corporationsecretary@ofcom.org.uk

A2. Ofcom's consultation principles

Ofcom has seven principles that it follows for every public written consultation:

Before the consultation

A2.1 Wherever possible, we will hold informal talks with people and organisations before announcing a big consultation, to find out whether we are thinking along the right lines. If we do not have enough time to do this, we will hold an open meeting to explain our proposals, shortly after announcing the consultation.

During the consultation

A2.2 We will be clear about whom we are consulting, why, on what questions and for how long.

A2.3 We will make the consultation document as short and simple as possible, with a summary of no more than two pages. We will try to make it as easy as possible for people to give us a written response. If the consultation is complicated, we may provide a short Plain English / Cymraeg Clir guide, to help smaller organisations or individuals who would not otherwise be able to spare the time to share their views.

A2.4 We will consult for up to ten weeks, depending on the potential impact of our proposals.

A2.5 A person within Ofcom will be in charge of making sure we follow our own guidelines and aim to reach the largest possible number of people and organisations who may be interested in the outcome of our decisions. Ofcom's Consultation Champion is the main person to contact if you have views on the way we run our consultations.

A2.6 If we are not able to follow any of these seven principles, we will explain why.

After the consultation

A2.7 We think it is important that everyone who is interested in an issue can see other people's views, so we usually publish all the responses on our website as soon as we receive them. After the consultation we will make our decisions and publish a statement explaining what we are going to do, and why, showing how respondents' views helped to shape these decisions.

A3. Consultation coversheet

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing ☐

Name/contact details/job title ☐

Whole response ☐

Organisation ☐

Part of the response ☐

If there is no separate annex, which parts? _____

_____

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here.

Name Signed (if hard copy)

A4. Consultation questions

A4.1 For the purpose of transparency and clarity, this annex contains an extract of the consultation questions which can be found in each of the sections of Volume 2 and 3 of this consultation.

Volume 2

Question 2.1: Do you agree with our proposed market definition of the WLA market? Please set out your reasons and supporting evidence for your response.

Question 2.2: Do you agree with our proposal that KCOM holds SMP in the supply of WLA products in the Hull Area? Please set out your reasons and supporting evidence for your response.

Question 3.1: Do you agree with our proposed market definition of the LL Access market? Please set out your reasons and supporting evidence for your response.

Question 3.2: Do you agree with our proposal that KCOM holds SMP in the supply of LL Access in the Hull Area? Please set out your reasons and supporting evidence for your response.

Question 4.1: Do you agree with our proposal not to regulate the WBA market in the Hull Area on the basis that the increased viability of use of KCOM's WLA FTTP product reduces the barriers to entry into the WBA market? Please set out your reasons and supporting evidence for your response.

Question 5.1: Do you agree with our proposal not to regulate WFAEL, ISDN2, ISDN30 and WCO markets on the basis that they no longer fulfil the three criteria test set out in the EC Recommendation? Please set out your reasons and supporting evidence for your response.

Volume 3

Question 1.1: Do you agree with our proposed approach to remedies? Please set out your reasons and supporting evidence for your response.

Question 2.1: Do you agree with our proposed remedies? Please set out your reasons and supporting evidence for your response.

Question 3.1: Do you agree with our proposed regulatory financial reporting SMP condition and directions? Please set out your reasons and supporting evidence for your response.

Question 5.1: Do you agree with our proposed transitional remedies for the WFAEL, ISDN2, ISDN30 and WCO markets? Please set out your reasons and supporting evidence for your response.

A5. Regulatory Framework

A5.1 This annex provides an overview of the regulatory framework relevant to the market review process, to give some additional context to the matters discussed in this document, including the legal instruments published in Volume 4.

A5.2 Market review regulation is technical and complex; and requires us to apply legislation and to take into account a number of relevant recommendations and guidelines. This overview identifies some of the key aspects of materials relevant to this market review but does not purport to give a full and exhaustive account of all materials that we have considered in reaching our proposals for these markets.

Market review concept

A5.3 A market review is a process by which, at regular intervals, we identify relevant markets appropriate to national circumstances and carry out analyses of these markets to determine whether they are effectively competitive. Where an operator has significant market power (SMP) in a market, we impose appropriate remedies, known as SMP obligations or conditions, to address this. We explain the concept of SMP below.

A5.4 In carrying out this work, we act in our capacity as the sector-specific regulator for the UK communications industries, including telecommunications. Our functions in this regard are to be found in Part 2 of the Communications Act 2003 (the Act). We exercise those functions within the framework harmonised across the European Union for the regulation of electronic communications by the Member States (known as the Common Regulatory Framework or CRF), as transposed by the Act. The currently applicable rules are contained in a package of five European Directives, of which two Directives are particularly relevant for present purposes, namely:

- Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services (the Framework Directive); and
- Directive 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities (the Access Directive).[1]

A5.5 The Directives require that National Regulatory Authorities (NRAs) such as Ofcom carry out reviews of competition in communications markets to ensure that SMP regulation remains appropriate and proportionate in the light of changing market conditions.

A5.6 Each market review normally involves three analytical stages, which are normally carried out together, namely:

- the identification and definition of the relevant markets (the market definition stage);

[1] The Directives were subsequently amended on 19 December 2009. The amendments have been transposed into the national legislation and applied with effect from 26 May 2011 and any references in this document to the Act should be read accordingly.

- the assessment of competition in each market, in particular whether the relevant market is effectively competitive (the market analysis stage); and
- the assessment of appropriate regulatory obligations (the remedies stage).

A5.7 The European Electronic Communications Code (the EECC), established by Directive EU 2018/1972, entered into force on 20 December 2018. The EECC amends and replaces the current CRF, including the Framework Directive and the Access Directive. It maintains the requirements on NRAs to review markets on a periodic basis, although there are changes to some of the detail of the obligations. Member States have until 21 December 2020 to transpose the EECC into national law. The UK Government consulted in July 2019 on its proposed approach to implementing the EECC into national law.[2] Its consultation included proposals on the key legislative changes that will be required to implement the EECC in the UK. The deadline for transposition is 21 December 2020. The requirement to transpose EU Directives will still apply to the UK by the time the deadline for transposing the EECC is reached. We therefore anticipate that the Act may be amended to reflect these provisions before we reach our final decisions on the matters set out in this consultation (our final statement is currently planned for early 2021).

Market definition

Relevant markets

A5.8 The Act provides that, before making a market power determination[3], we must identify "the markets which in [our] opinion are the ones which in the circumstances of the United Kingdom are the markets in relation to which it is appropriate to consider whether to make such a determination" and analyse those markets.

A5.9 The Framework Directive requires that NRAs shall, taking the utmost account of the 2014 Recommendation on Relevant Markets (2014 EC Recommendation)[4] and EC SMP Guidelines[5] published by the European Commission (EC), define the relevant markets appropriate to national circumstances, in particular relevant geographic markets within their territory, in accordance with the principles of competition law.

A5.10 The 2014 EC Recommendation identifies a set of product and service markets within the electronic communications sector in which *ex ante* regulation may be warranted. Its purpose is twofold. First, it seeks to achieve harmonisation across the single market by ensuring that the same markets will be subject to a market analysis in all Member States.

[2] Department for Digital, Culture, Media and Sport, Implementing the European Electronic Communications Code, 16 July 2019.
[3] The market power determination concept is used in the Act to refer to a determination that a person has SMP in an identified services market.
[4] Commission Recommendation of 9 October 2014 on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services (2014/710/EU).
[5] Guidelines on market analysis and the assessment of significant market power under the EU regulatory framework for electronic communications networks and services (2018/C 159/01).

Second, the 2014 EC Recommendation seeks to provide legal certainty by making market players aware in advance of the markets to be analysed.

A5.11 However, NRAs are able to regulate markets that differ from those identified in the 2014 EC Recommendation where this is justified by national circumstances by demonstrating that three criteria referred to in the 2014 EC Recommendation (the three-criteria test) are satisfied and where the EC does not raise any objections.

A5.12 The three criteria, which are cumulative, are:

- the presence of high and non-transitory structural, legal or regulatory barriers to entry;
- a market structure which does not tend towards effective competition within the relevant time horizon, having regard to the state of infrastructure-based and other competition behind the barriers to entry; and
- competition law alone is insufficient to adequately address the identified market failure(s).[6]

A5.13 The fact that an NRA identifies the product and service markets listed in the 2014 EC Recommendation or identifies other product and service markets that meet the three-criteria test does not automatically mean that regulation is warranted. Market definition is not an end in itself but rather a means of assessing effective competition.

A5.14 The relationship between the market definitions identified in this review and those listed in the 2014 EC Recommendation is discussed in relevant parts of this document.

Forward look

A5.15 The EC SMP Guidelines make clear that market definition is not a mechanical or abstract process. It requires an analysis of any available evidence of past market behaviour and an overall understanding of the mechanics of a given market sector. As market analysis has to be forward-looking, the EC SMP Guidelines state that NRAs should determine whether the market is prospectively competitive, and thus whether any lack of effective competition is durable, by taking into account expected or foreseeable market developments over the course of a reasonable period.[7] The EC SMP Guidelines clarify that NRAs enjoy discretionary powers which reflect the complexity of all the relevant factors that must be assessed (economic, factual and legal) when identifying the relevant market and assessing whether an undertaking has SMP.

Modified Greenfield

A5.16 The EC SMP Guidelines state that the starting point for the identification of wholesale markets susceptible for *ex ante* regulation should always be the analysis of corresponding

[6] The three-criteria test and the SMP assessment may make use of similar indicators – see 2014 EC Recommendation, paragraph 11.
[7] EC SMP Guidelines, paragraphs 15-18. The EC SMP Guidelines provide that the actual period used should reflect the specific characteristics of the market and the expected timing for the next review of the relevant market by the NRA.

retail market(s). NRAs should determine whether the underlying retail market(s) is (are) prospectively competitive in absence of wholesale regulation based on a finding of SMP, and therefore whether any lack of effective competition is durable. However, the analysis should take into account the effects of other types of (sector-specific) regulation, decisions or legislation applicable to the relevant retail and related wholesale market(s) during the relevant period. This is known as a Modified Greenfield approach.[8]

A5.17 If the underlying retail market(s) is (are) prospectively competitive under the Modified Greenfield approach, the NRA should conclude that regulation is no longer needed at wholesale level. If the underlying retail market(s) is (are) not prospectively competitive, then the corresponding wholesale markets susceptible to regulation should be assessed. Where wholesale markets are vertically linked, the most upstream market should be analysed first. The NRA should conduct a gradual analysis of the markets that are downstream from a regulated input, to determine whether they would be effectively competitive in the presence of regulation upstream, until it reaches the final retail market. A downstream market should only be subject to *ex ante* regulation if competition on that market still exhibits SMP despite the presence of *ex ante* regulation on the related wholesale upstream market.[9]

Product and geographic dimensions

A5.18 The EC SMP Guidelines also describe how competition law methodologies may be used by NRAs in their analysis. In particular, there are two dimensions to the definition of a relevant market: the relevant products to be included in the same market and the geographic extent of the market.

A5.19 The boundaries between markets are determined by identifying competitive constraints on the price setting behaviour of firms. The EC SMP Guidelines set out that there are two main constraints to consider[10]:

- to what extent it is possible for a customer to substitute other services for those in question in response to a relative price increase (demand-side substitution); and
- to what extent suppliers can switch, or increase, production to supply the relevant products or services in response to a relative price increase (supply-side substitution).

A5.20 The hypothetical monopolist test is a tool used to identify close demand-side and supply-side substitutes. In this test, a product is considered to constitute a separate market if the hypothetical monopolist supplier could impose a small but significant non-transitory increase in price (SSNIP) above the competitive level without losing sales to such a degree as to make this price rise unprofitable.[11] If such a price rise would be unprofitable, because consumers would switch to other products or because suppliers of other products would

[8] EC SMP Guidelines, paragraphs 15-18.
[9] 2014 EC Recommendation, Recitals 7, 10 18 and 21.
[10] See paragraph 27 of the EC SMP Guidelines, which also notes that potential competition also acts as a third source of competitive constraint on an operator's behaviour but is taken into account in the SMP assessment.
[11] EC SMP Guidelines, paragraph 29.

begin to compete with the hypothetical monopolist, then the market definition should be expanded to include the substitute products.

A5.21 The starting point for the application of hypothetical monopolist test can be referred to as the 'focal product',[12] and typically starts from the narrowest potential market definition.[13]

A5.22 Having considered demand-side substitution we then, where relevant, assess supply-side substitution possibilities to consider whether they provide any additional constraints on the pricing behaviour of the hypothetical monopolist which have not been captured by the demand-side analysis. In this assessment, supply-side substitution is considered to be a low-cost form of entry which can take place within a reasonable timeframe (e.g. up to 12 months). For supply-side substitution to be relevant not only must suppliers be able, in theory, to enter the market quickly and at low cost by virtue of their existing position in the supply of other products or geographic areas, but there must also be an additional competitive constraint arising from such entry into the supply of the service in question.

A5.23 Therefore, in identifying potential supply-side substitutes, it is important that providers of these services have not already been taken into consideration. There might be suppliers who provide other services but who might also be materially present in the provision of demand-side substitutes to the service for which the hypothetical monopolist has raised its price. Such suppliers are not relevant to supply-side substitution since they supply services already identified as demand-side substitutes. However, the impact of expansion by such suppliers can be taken into account in the assessment of market power.

A5.24 In relation to defining the relevant geographic markets, the EC SMP Guidelines explain this comprises an area in which the undertakings concerned are involved in the supply and demand of the relevant products or services, in which the conditions of competition are sufficiently homogeneous, and which can be distinguished from neighbouring areas in which the prevailing conditions of competition are significantly different. Areas in which the conditions of competition are heterogeneous do not constitute a uniform market.[14]

A5.25 Ofcom's approach to market definition follows that used by the UK competition authorities, is consistent with the EC SMP Guidelines and in line with the approach adopted by the EC.

Relationship with *ex post* competition law

A5.26 While competition law methodologies are used in identifying the relevant markets *ex ante*, the markets identified will not necessarily be identical to markets defined in *ex post* competition law cases, especially as the markets identified *ex ante* are based on an overall forward-looking assessment of the structure and the functioning of the market under

[12] This reflects the terminology used by the OFT Market Definition Guidelines (OFT, December 2004. Market definition OFT403 [Accessed 8 July 2020]).
[13] Paragraph 3.2 of the OFT Market Definition Guidelines explains that 'previous experience and common sense will normally indicate the narrowest potential market definition, which will be taken as the starting point for the analysis'.
[14] EC SMP Guidelines, paragraph 48.

examination. Accordingly, the economic analysis carried out for the purpose of this review, including the markets we have identified, is without prejudice to any analysis that may be carried out in relation to any investigation pursuant to the Competition Act 1998[15] (relating to the application of the Chapter I or II prohibitions or Article 101 or 102 of the Treaty on the Functioning of the European Union) or the Enterprise Act 2002.[16]

Market analysis

Effective competition

A5.27 The Act requires that we carry out market analyses of identified markets for the purpose of making or reviewing market power determinations. Such analyses are normally to be carried out within two years from the adoption of a revised recommendation on markets, where that recommendation identifies a market not previously notified to the EC, or within three years from the publication of a previous market power determination relating to that market. Exceptionally, the three-year period may be extended for up to three additional years where the NRA notifies the EC, and it does not object.

A5.28 The EECC amends these time periods such that market power analyses should be carried out within three years from the adoption of a revised recommendation on markets, for markets not previously notified to the EC, or within five years from the adoption of a previous market power determination. Exceptionally, the five-year period may be extended for up to one additional year, where the NRA notifies the EC, and it does not object.[17]

A5.29 In carrying out a market analysis, the key issue for an NRA is to determine whether the market in question is effectively competitive. Recital 27 to the Framework Directive clarifies the meaning of that concept:

"It is essential that *ex ante* regulatory obligations should only be imposed where there is not effective competition, i.e. in markets where there are one or more undertakings with significant market power, and where national and Community competition law remedies are not sufficient to address the problem".

A5.30 The definition of SMP is equivalent to the concept of dominance as defined in competition law. In essence, it means that an undertaking in the relevant market is in a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers, and ultimately consumers. The Framework Directive requires that NRAs must carry out their market analysis taking utmost account of the EC SMP Guidelines, which emphasise that NRAs should undertake a thorough and overall analysis of the economic characteristics of the relevant market before coming to a conclusion as to the existence of SMP.

[15] Competition Act 1998, [Accessed 8 July 2020].
[16] Enterprise Act 2002, Chapter 40, [Accessed 8 July 2020].
[17] EECC, Article 67(5).

A5.31 In line with the EC SMP Guidelines we consider that market shares provide a useful first indication of competitive conditions in the market, and that they should however be interpreted in light of the relevant market conditions.[18]

A5.32 In that regard, the EC SMP Guidelines set out, additionally to market shares, criteria that can be used by NRAs to measure the power of an undertaking to behave to an appreciable extent independently of its competitors, customers, and consumers, including:

- barriers to entry;
- barriers to expansion;
- absolute and relative size of the undertaking;
- control of infrastructure not easily duplicated;
- technological and commercial advantages or superiority;
- absence of or low countervailing buying power;
- easy or privileged access to capital markets/financial resources;
- product/services diversification (for example, bundled products or services);
- economies of scale and economies of scope;
- direct and indirect network effects;
- vertical integration;
- a highly developed distribution and sales network;
- conclusion of long-term and sustainable access agreements;
- engagement in contractual relations with other market players that could lead to market foreclosure; and
- absence of potential competition.[19]

A5.33 A dominant position can derive from a combination of these criteria which when taken separately may not necessarily be determinative. However, according to established case law, a market share in excess of 50% is itself evidence of a dominant position, save in exceptional circumstances.[20]

Sufficiency of competition law

A5.34 As part of our overall forward-looking analysis, we also assess whether competition law by itself (without *ex ante* regulation) is sufficient, within the relevant markets we have defined, to address the competition problems we have identified. We consider this matter in our assessment of the appropriate remedies which, as explained below, are based on the nature of the specific competition problems we identify within the relevant markets as defined. We also note that the EC SMP Guidelines clarify that, if NRAs designate undertakings as having SMP, they must impose on them one or more regulatory obligations.

A5.35 In considering this matter, we bear in mind the specific characteristics of the relevant markets we have defined. Generally, the case for *ex ante* regulation is based on the

[18] EC SMP Guidelines, paragraph 54.
[19] EC SMP Guidelines, paragraph 58.
[20] EC SMP Guidelines, paragraph 55.

existence of market failures which, by themselves or in combination, mean that the establishment of effective competition might not be possible if the regulator relied solely on *ex post* competition law powers which are not specifically tailored to the sector. Therefore, it may be appropriate for *ex ante* regulation to be used to address such market failures along with any entry barriers that might otherwise prevent effective competition from becoming established within the relevant markets we have defined. By imposing *ex ante* regulation that promotes competition, it may be possible to reduce such regulation over time as markets become more competitive, allowing greater reliance on *ex post* competition law.

A5.36 *Ex post* competition law is also unlikely in itself to bring about (or promote) effective competition, as it prohibits the abuse of dominance rather than the holding of a dominant position itself. In contrast, *ex ante* regulation is normally aimed at actively promoting the development of competition through attempting to reduce the level of market power (or dominance) in the identified relevant markets, thereby encouraging the establishment of effective competition.

A5.37 We generally take the view that *ex ante* regulation provides additional legal certainty for the market under review and may also better enable us to intervene in a timely manner. We may also consider that certain obligations are needed as competition law would not remedy the particular market failure, or that the specific clarity and detail of the obligation is required to achieve a particular result.

Remedies

Powers and legal tests

A5.38 The Framework Directive prescribes what regulatory action NRAs must take depending upon whether or not an identified relevant market has been found effectively competitive. Where a market has been found effectively competitive, NRAs are not allowed to impose SMP obligations and must withdraw such obligations where they already exist. On the other hand, where the market is found not effectively competitive, the NRAs must identify the undertakings with SMP in that market and then impose appropriate obligations.

A5.39 NRAs have a suite of regulatory tools at their disposal, as reflected in the Act and the Access Directive. Specifically, the Access Directive identifies a number of SMP obligations, including transparency, non-discrimination, accounting separation, access to and use of specific network elements and facilities, price control and cost accounting. When imposing a specific obligation, the NRA will need to demonstrate that the obligation in question is based on the nature of the problem identified, proportionate and justified in the light of the policy objectives as set out in Article 8 of the Framework Directive.[21]

[21] Access Directive, Article 8(4). The equivalent requirement in Article 68 of the EECC is that the obligation imposed is based on the nature of the problem identified, where appropriate taking into account the identification of transnational demand; proportionate, having regard, where possible, to the costs and benefits; justified in light of the objectives set out in Article 3 of the EECC; and imposed following consultation in accordance with Articles 23 and 32 of the EECC.

A5.40 Specifically, for each and every SMP obligation, we will explain why it satisfies the requirement in section 47(2) of the Act that the obligation is:

- objectively justifiable in relation to the networks, services, facilities, apparatus or directories to which it relates;
- not such so as to discriminate unduly against particular persons or against a particular description of persons;
- proportionate to what the condition or modification is intended to achieve; and
- transparent in relation to what is intended to be achieved.

A5.41 Additional legal requirements may also need to be satisfied depending on the SMP obligation in question. For example, NRAs are subject to additional requirements when imposing price controls and cost recovery obligations.[22]

A5.42 Specifically, we will explain why any such SMP obligation satisfies the requirements of section 88 of the Act. Namely:

- our analysis indicates a risk that the telecoms provider concerned might fix and maintain prices at an excessively high level or impose a price squeeze so as to have adverse consequences for end-users of public electronic communications services;
- we consider the setting of the obligation is appropriate for the purposes of promoting efficiency, promoting sustainable competition and conferring the greatest possible benefits on the end-users of public electronic communications services; and
- we have taken account of the extent of investment by the telecoms provider in the matters to which the SMP obligation relates.

A5.43 Where an obligation to provide third parties with network access is considered appropriate, NRAs must take into account factors including the feasibility of the network access, the technical and economic viability of creating networks that would make the network access unnecessary, the investment of the network operator who is required to provide access (taking account of any public investment made), and the need to secure effective competition (including, where it appears to us to be appropriate, economically efficient infrastructure-based competition) in the long term.[23]

A5.44 We demonstrate the application of these requirements to our proposed SMP obligations, to the extent relevant, in this consultation document. In doing so, we also set out our assessment of how, in our opinion, the performance of our general duties under section 3 of the Act will be secured or furthered by our proposed regulatory intervention, and that it is in accordance with the six European Community requirements in section 4 of the Act

[22]Access Directive, Article 13. The equivalent provisions in Article 74 of the EECC are broadly similar. However, in determining whether price controls would be appropriate, NRAs are required to take into account the need to promote competition and long-term end-user interests related to the deployment and take-up of next- generation networks, and in particular of very high capacity networks. When NRAs consider it appropriate to impose price controls on access to existing network elements, they are also required to take account of the benefits of predictable and stable wholesale prices in ensuring efficient market entry and sufficient incentives for all undertakings to deploy new and enhanced networks. In addition, any mandated cost recovery mechanism or pricing methodology must promote the deployment of new and enhanced networks (in addition to the existing requirements to promote efficiency and sustainable competition and maximise end-user benefits).

[23] Section 87 of the Act; Access Directive, Article 12. The equivalent provisions are in Article 73 of the EECC.

(see below). This is also relevant to our assessment of the likely impact of implementing our decisions.

Ofcom's general duties – section 3 of the Act

A5.45 Under the Act, our principal duty in carrying out our functions is to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition.

A5.46 In doing so, we are required to secure a number of specific objectives and to have regard to a number of matters set out in section 3 of the Act.

A5.47 In performing our duties, we are also required to have regard to a range of other considerations, as appear to us to be relevant in the circumstances. For the purpose of this review, we consider that a number of such considerations are relevant, in particular:

- the desirability of promoting competition in relevant markets;
- the desirability of encouraging investment and innovation in relevant markets; and
- the desirability of encouraging the availability and use of high-speed data transfer services throughout the UK.

A5.48 We are also required to have regard to the principles under which regulatory activities should be transparent, accountable, proportionate, consistent, and targeted only at cases in which action is needed, as well as to the interest of consumers in respect of choice, price, quality of service and value for money.

A5.49 However, Ofcom has a wide measure of discretion in balancing its statutory duties and objectives. In doing so, we take account of all relevant considerations, including responses received during our consultation process, in reaching our conclusions.

European Community requirements for regulation – sections 4 and 4A of the Act, Article 3 of the BEREC Regulation and Article 3 of the EECC

A5.50 As noted above, our functions exercised in this review fall under the CRF. As such, section 4 of the Act requires us to act in accordance with the six Community requirements for regulation, which are derived from Article 8 of the Framework Directive.[24] In summary, these six requirements are:

a) to promote competition in the provision of electronic communications networks and services, associated facilities and the supply of directories;

b) to contribute to the development of the European internal market;

c) to promote the interests of all persons who are citizens of the EU;

[24] The UK left the European Union on 31 January 2020. A consequence of this is that some of our functions under the Act, including certain functions relevant to this review, will be amended. We consider that the proposals set out in this consultation would continue to fall within the scope of our powers and meet our duties post-Brexit.

d) to take account of the desirability of Ofcom's carrying out of its functions in a manner which, so far as practicable, does not favour one form of or means of providing electronic communications networks, services or associated facilities over another (i.e. to be technologically neutral);

e) to encourage, to such extent as Ofcom considers appropriate for certain prescribed purposes: the provision of network access and service interoperability; securing efficient and sustainable competition; efficient investment and innovation; and the maximum benefit for customers of telecoms providers; and

f) to encourage compliance with certain standards in order to facilitate service interoperability and secure freedom of choice for the customers of telecoms providers.

A5.51 We consider that the first, third, fourth, and fifth of those requirements are of particular relevance to the matters under review and that no conflict arises in this regard with those specific objectives in section 3 of the Act that we consider are particularly relevant in this context.

A5.52 Article 3 of the EECC amends and replaces Article 8 of the Framework Directive. NRAs' general obligations in Article 3 of the EECC mirror to a large extent the Community requirements currently in section 4 the Act. However, Article 3 of the EECC introduces a new objective for NRAs to promote connectivity, access to, and take-up of, very high capacity networks, including fixed, mobile and wireless networks, by all citizens and businesses of the Union (the connectivity objective). The objective to promote competition also includes an explicit reference to promoting efficient infrastructure-based competition. Another change from the current framework is that Article 3 of the EECC specifies that the promotion of citizens' interests includes ensuring connectivity and the widespread availability and take-up of very high capacity networks. Recital 24 of the EECC explains that work towards securing the connectivity objective should be assessed by, amongst other things, the availability to all households of networks which are capable of providing connection speeds of at least 100 Mbps, and which are promptly upgradeable to gigabit speeds.

A5.53 Section 4A of the Act requires Ofcom, in carrying out certain of its functions (including, among others, Ofcom's functions in relation to market reviews under the CRF), to take due account of applicable recommendations issued by the EC under Article 19(1) of the Framework Directive. Where we decide not to follow such a recommendation, we must notify the EC of that decision and the reasons for it.

A5.54 Further, Article 3(3) of the Regulation establishing BEREC[25] requires NRAs to take utmost account of any opinion, recommendation, guidelines, advice or regulatory best practice adopted by BEREC.

[25] Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators of Electronic Communications (BEREC) and the Office (the BEREC Regulation).

Impact assessment – section 7 of the Act

A5.55 The analysis presented in this consultation document represents an impact assessment, as defined in section 7 of the Act.

A5.56 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in section 7 of the Act, which means that generally Ofcom has to carry out impact assessments where there is likely to be a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities. However, as a matter of policy, Ofcom is committed to carrying out and publishing impact assessments in relation to the majority of its policy decisions.[26]

A5.57 Specifically, pursuant to section 7, an impact assessment must set out how, in our opinion, the performance of our general duties (within the meaning of section 3 of the Act) is secured or furthered by or in relation to the regulation we impose.

A5.58 Ofcom must also assess the potential impact of all our functions, policies, projects, and practices on equality.[27] This assessment is set out in Volume 1 paragraphs 4.5 to 4.11.

Regulated entity

A5.59 The power in the Act to impose an SMP obligation by means of an SMP services condition provides that it is to be applied only to a "person" whom we have determined to be a person having SMP in a specific market for electronic communications networks, electronic communications services or associated facilities (i.e. the "services market").

A5.60 The Framework Directive requires that, where an NRA determines that a relevant market is not effectively competitive, it shall identify "undertakings" with SMP in that market and impose appropriate specific regulatory obligations. For the purposes of EU competition law, "undertaking" includes companies within the same corporate group (for example, where a company within that group is not independent in its decision making).[28]

A5.61 We consider it appropriate to prevent a dominant provider to whom an SMP services condition is applied, which is part of a group of companies, exploiting the principle of corporate separation. The dominant provider should not use another member of its group to carry out activities or to fail to comply with a condition, which would otherwise render the dominant provider in breach of its obligations.

A5.62 To secure that aim, we apply the SMP conditions to the person in relation to which we have made the market power determination in question by reference to the so-called "Dominant Provider", which we define as "KCOM Group Limited, whose registered

[26] For further information about Ofcom's approach to impact assessments, see the guidelines, Ofcom 2005, Better Policy Making: Ofcom's approach to Impact Assessment.
[27] Ofcom has a general duty under the 2010 Equality Act to advance equality of opportunity in relation to age, disability, sex, gender reassignment, pregnancy and maternity, race, religion or belief, and sexual orientation.
[28] Case C-73/95 P *Viho v Commission*, [1996] ECR I-5447, [Accessed 8 July 2020].

company number is 02150618, and any of its subsidiaries as defined in section 1159 of the Companies Act 2006.

A6. Overview of telecoms networks

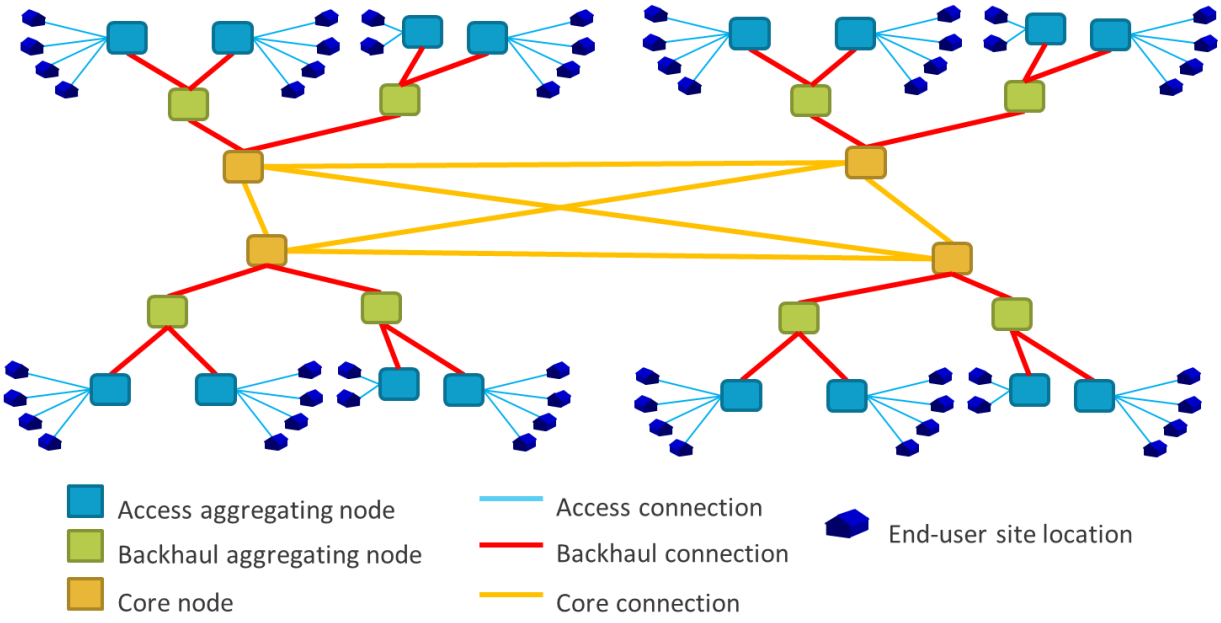
General overview

A6.1 A communications network provides the services that enable end-users to exchange information. A network is comprised of a number of elements:

- Access connections;
- Backhaul and core connections; and
- Network nodes which house equipment.

A6.2 Figure A6.1 sets out a high-level view of how networks are typically structured.

Figure A6.1: Illustration of logical arrangement of a communications network



Source: Ofcom.

A6.3 Each end-user site is connected to one of the network's access aggregating nodes.[29] This is referred to as the 'access connection'. Each access node is connected to at least one core node, either directly or indirectly, via a backhaul aggregating node[30] using a backhaul connection.[31] Core nodes are typically connected to each other to form a core network.[32]

[29] Access aggregating nodes aggregate the traffic from access connections and may also be referred to as access nodes. The access connection may be a radio, fibre, or copper bearer.
[30] Backhaul aggregating nodes may also be referred to as backhaul, aggregating, or metro nodes. A backhaul aggregating node multiplexes the backhaul connections (or data traffic flows) onto a common bearer in a way that maintains the individual identity of each aggregated backhaul connection.
[31] Access or aggregating (backhaul) nodes may be connected to two or more core nodes to create a resilient network by providing alternative routing in the event of failure of a core node or backhaul connection.
[32] Core nodes are used to route or switch traffic between other core nodes. They are sometimes further divided into a hierarchy of outer core edge nodes and inner core nodes. Most core nodes have duplicate connections between them to provide resilience in the event of a failure in the network equipment or connection.

In general, there are more access nodes than backhaul nodes and more backhaul nodes than core nodes.

A6.4 This structure is common to the networks used to provide most voice and data telecoms services – including telephony, fixed broadband, mobile, and leased lines. These networks differ in scale (numbers of each type of node), the number of stages of access and backhaul aggregation (zero, one or more than one) and the structure of the core.

A6.5 Access aggregating nodes are generally placed where end-user customers are grouped most closely and can be easily reached (such as the centre of cities, towns, and villages) and are used to connect end-user customer access connections to the network.

A6.6 Backhaul nodes have higher capacity as they aggregate traffic from multiple access nodes and can act as the point of connection between access nodes which can be many kilometres apart. Backhaul connections will have higher capacity than access connections as they aggregate traffic from multiple end-user customers and services.

A6.7 Core connections (and nodes) transport multiple telecoms services aggregated from all the services provided to end-user customers and generally have higher capacity than backhaul connections (and nodes). Core nodes are typically located in a city of significant population within the geographic area covered by the network. Core nodes typically route (or switch) traffic from backhaul connections onto the core network, or between backhaul nodes or other core nodes.

A6.8 Most locations or sites housing core nodes also contain backhaul and access aggregating nodes, the latter for serving the area immediately surrounding the site.[33] Similarly, a site containing a backhaul node may also contain one or more access nodes to provide connectivity to the surrounding area. More remote network sites may only contain an access node.

A6.9 To enable communication between different networks[34], networks are interconnected between designated nodes. The network-to-network interconnect may be at a site (point of handover) where both networks are present, such as at a KCOM exchange or a data centre, or via a dedicated point-to-point connection between two network sites where the interconnection or handovers takes place.[35]

[33] Aggregation nodes (access, backhaul, and core) can be sited in, for example, a telecoms provider's operational building, in a BT or KCOM exchange, or in a data centre. Some sites may have more than one type of aggregation node at the same location.
[34] For example, between two different business users, or between a business user and a serving computer such as a web server in a data centre, or simply between two network operators.
[35] KCOM provides products to connect between nodes within a KCOM exchange (Internal Ethernet Connect Access Service, ECAS) and to connect to other networks nearby (External Ethernet Connect Access Service, ECAS).

Access networks

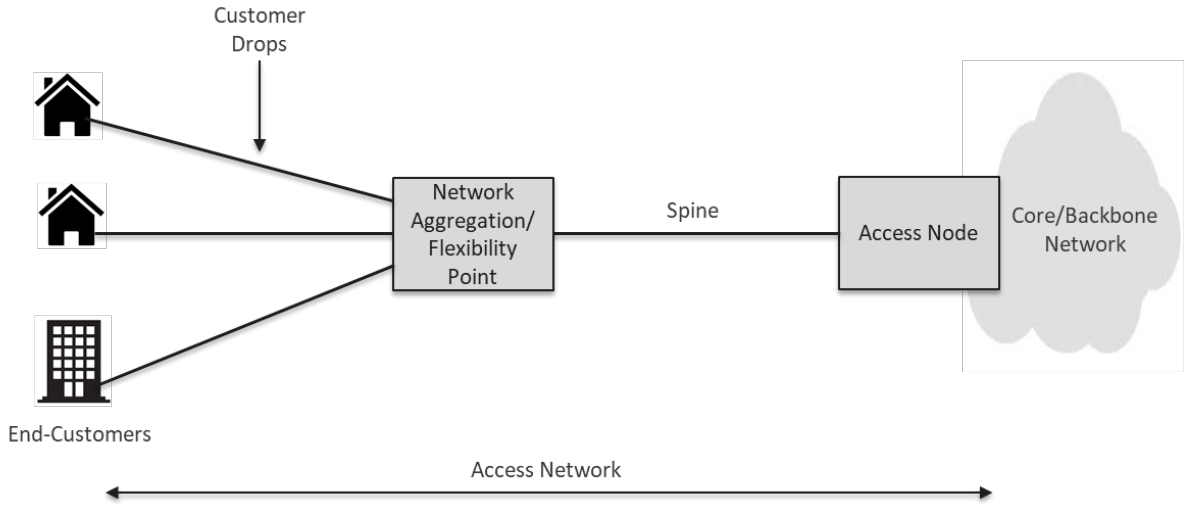
Access network overview

A6.10 Access networks provide the connection to the end customer. The connection to the end-user customer from the access node may be realised all, or in part, using fixed connectivity (fibre, copper, coaxial cables) or using wireless connectivity.

A6.11 While there are a number of different types of access network, all share certain common attributes which make up the access connection between end-user sites and an access aggregating node, such as end-user customer drops, aggregation/flexibility points, spine links and access nodes.

A6.12 Figure A6.2 below illustrates how the constituent elements typically relate to one another.

Figure A6.2: Generic fixed access network



Source: Ofcom.

A6.13 End-user customer drops, or lead-ins, are the dedicated physical bearer (or radio links in the case of wireless networks) connecting an end-customer's equipment (called customer premises equipment (CPE)) or mobile terminals, to the network.

A6.14 Aggregation nodes or flexibility points terminate a number of end-user customer drops and either aggregate traffic or consolidate multiple transmission bearers into a smaller number for backhaul purposes.[36]

A6.15 Spine links are transmission bearers that carry aggregated end-user customer traffic from an aggregation node or flexibility point to an access node. Access nodes host the technology-specific equipment that controls the access network.

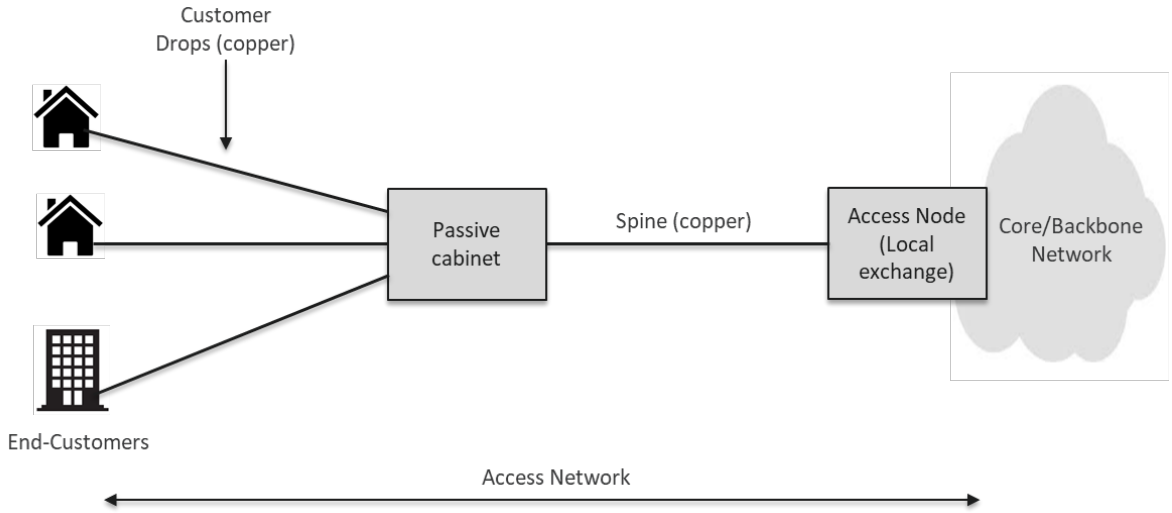
[36] In some access networks, the aggregation node can also perform some of the functions of the access node (e.g. DSL-based FTTC).

Fixed broadband and telephony for residential/SME end-user customers

A6.16 Networks that supply broadband and telephony services to residential and Small and Medium sized Enterprises (SMEs) need to be able to deliver connections to new end-user customers reasonably quickly on request and for a relatively low cost. The timescales and costs for connections should be broadly similar so that a standard connection can be offered. This means that these networks need to be deployed to have access points very close to prospective end-user customers ahead of accepting offers from end-user customers.

A6.17 Networks were initially deployed using copper connections to the end-user customer premises as shown in Figure A6.3 below.

Figure A6.3: Copper access network

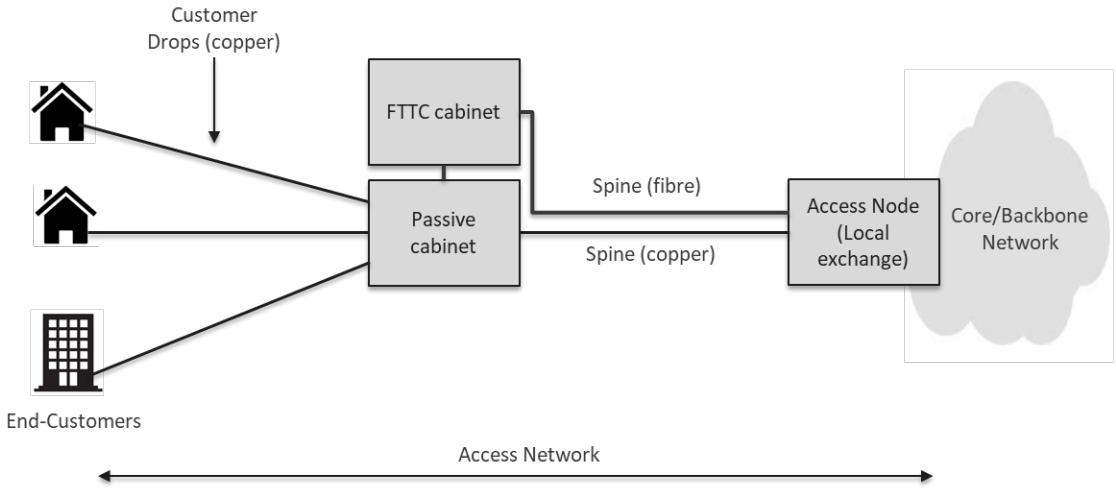


Source: Ofcom.

A6.18 Copper networks were initially deployed to provide telephony services. Broadband services were added by providing broadband equipment at the local exchange. The characteristics of this equipment and the copper line limited the speed available on the network, initially up to 8Mbit/s and, ultimately, to about 24Mbit/s (with end-user customers experiencing less than this, based on the length of the copper connection, quality of connection, etc.).

A6.19 This network could be upgraded to support higher speeds by deploying broadband equipment at the cabinet location, as shown in Figure A6.4.

Figure A6.4: Fibre to the cabinet access network



Source: Ofcom.

A6.20 This fibre-to-the-cabinet (FTTC) network can provide broadband services with speeds up to 80Mbit/s downstream, depending on the length of the remaining copper line from the end-user customer to the cabinet. FTTC networks can also be used to support legacy analog telephony services over copper phone lines ('customer drops'), while allowing core PSTN infrastructure to be changed out for an IP core network.

A6.21 To achieve speeds above this, the potential technologies include:

- G.fast;
- Coaxial cable; and/or
- Fibre To The Premises (FTTP).

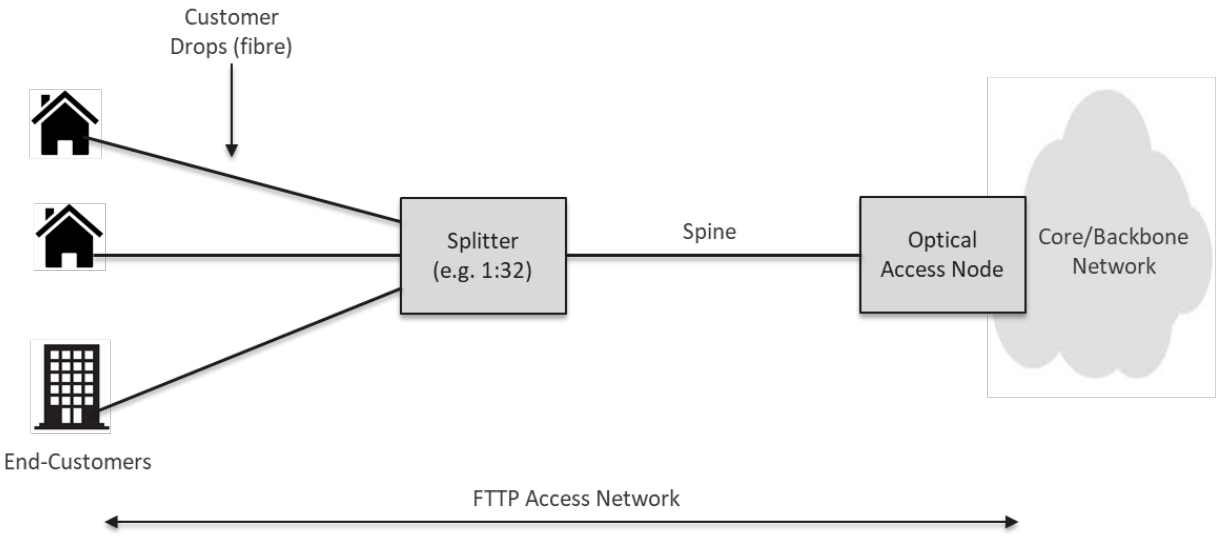
A6.22 G.fast is a technology that relies on the existing copper connection to the end customer. The G.fast equipment can be placed close to the end-user customer (for example near the final distribution point) to attain very high speeds. Openreach has deployed G.fast equipment at selected cabinets and offers services at up to 330Mbit/s.

A6.23 FTTP networks can be provided in two main ways:

Passive Optical Network (PON); or
Point to point fibres (PtP).

A6.24 A PON is a shared fibre network, as shown in Figure A6.5.

Figure A6.5: Fibre to the premises passive optical network



Source: Ofcom.

A6.25 In the PON, each end-user customer has a dedicated fibre connecting it to a splitter. Between the splitter and the optical access node, the traffic of a number of end-user customers (typically up to 32) are combined on a single fibre, so that the PON's capacity is shared between multiple users. A GPON, or gigabit PON, is a common example of currently-deployed PONs, and they typically support 2.5Gbit/s downstream and 1Gbit/s upstream, but with an expectation this can be upgraded fairly straightforwardly. A roadmap of enhancements and future developments, with higher bandwidths and enhanced features and functionality, will allow PONs to continue to be used as demand grows over the coming years.

A6.26 Whilst the GPON capacity is shared so that theoretically end-user customers could experience congestion, telecoms providers deploying GPONs can generally offer end-user customers up to 1Gbit/s symmetric services, on the basis that end-user customers will not usually demand the full speed.

A6.27 The majority of FTTP deployments are GPONs, as is KCOM's current FTTP network.

A6.28 Alternatively, an FTTP network can be deployed as a point-to-point (PtP) infrastructure. In this case, each end-user customer has their own fibre all the way to the optical access node. This means end-user customers do not suffer congestion due to other end-user customers' demands in the access network, but means there needs to be much more equipment at the access node to terminate and light every fibre.

Specific characteristics of KCOM's fixed access network in the Hull Area

A6.29 KCOM's residential fixed access network in the Hull Area differs from the equivalent Openreach access network throughout the rest of the UK in a number of ways and KCOM's access network is also evolving.

A6.30 The overwhelming majority of residential premises in the Hull Area are currently served by two fixed access networks from KCOM and therefore (depending on the services they subscribe to) premises could be connected by a legacy twisted-pair copper cable and a fibre-optic cable. These twin cables into each premises are bonded together and referred to as 'shot-gun' cables.[37]

A6.31 The copper telephone lines are used to deliver voice and older, DSL-based broadband services, while the fibre cables deliver KCOM's higher-speed FTTP-based broadband services.

A6.32 KCOM's fixed access network is evolving from an all-copper, circuit-switched PSTN – referred to by KCOM as its Stage 1 network - equivalent in all key respects to BT's legacy PSTN, to an all-IP, FTTP-based network supporting all fixed residential services – its so-called Stage 4 network. While KCOM has recognised that Stage 4 (all-IP FTTP network) is its technical objective, there are currently no plans to migrate to this point of network evolution.

A6.33 This access network evolution, from the Stage 1 legacy PSTN to the target all-IP FTTP network (Stage 4), passes through two intermediate stages:

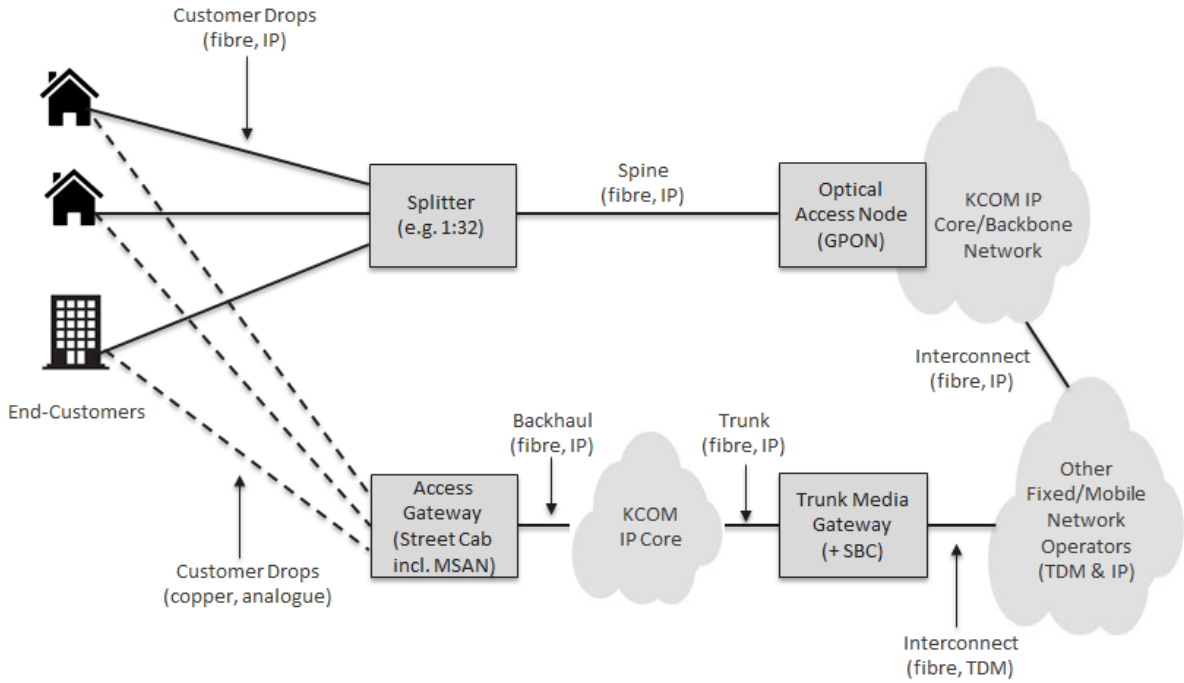
a) Stage 2: IP core network with TDM interconnects and legacy copper service delivery to end-user customers; and

b) Stage 3: as per Stage 2, but with TDM interconnects replaced by IP interconnects.

A6.34 At the time of writing, KCOM is at Stage 2 of its network evolution, as illustrated in Figure A6.6 below.

[37] The key exception to this rule is new-build estates within the Hull Area where legacy copper cables are not deployed and therefore premises are only served by fibre-optic cables which provide all residential services (voice and broadband).

Figure A6.6: KCOM Hull Area access network (Stage 2, current)

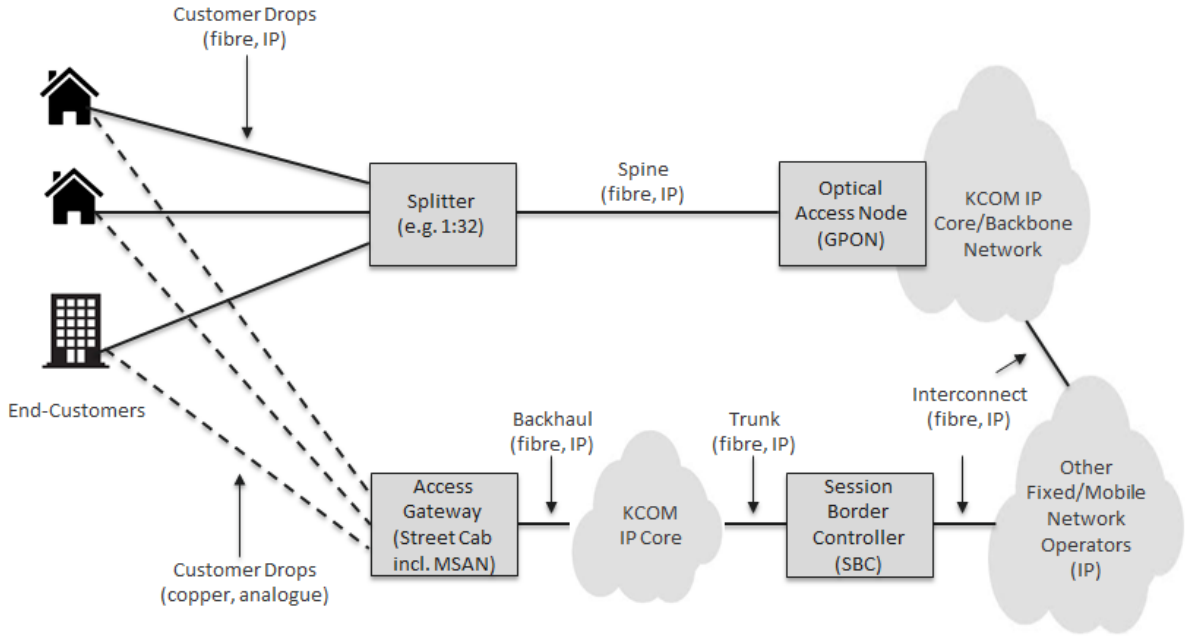


Source: Ofcom analysis based on KCOM's 2nd RFI' response.

A6.35 KCOM's GPON[38] FTTP access network is shown across the top of Figure A6.6, while along the bottom the copper access network is set out. The current Stage 2 network distinguishes itself by having an IP-based core network, with gateway devices on both the end-customer access and trunk interconnect sides of the network to convert IP packets to and from legacy analogue, circuit-switched transmission.

[38] GPON refers to 'gigabit passive optical network' and is one of the common technologies used in conjunction with an FTTP-based access network.

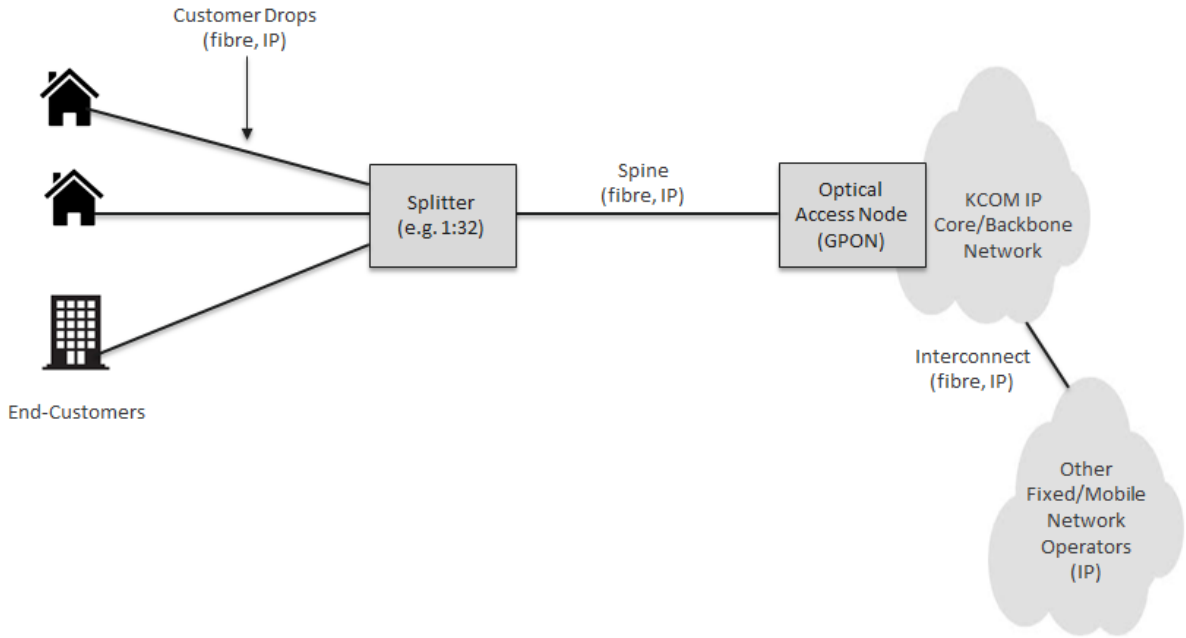
Figure A6.7: KCOM Hull Area access network (Stage 3, IP interconnect)



Source: Ofcom analysis based on KCOM's 2nd RFI response.

A6.36 Figure A6.7 illustrates the Stage 3 of KCOM's access network evolution, which differs from Stage 2 primarily by moving to an IP-based interconnect solution; all other aspects of the network remain unchanged.

Figure A6.8: KCOM Hull Area access network (Stage 4, all-IP)



Source: Ofcom analysis based on KCOM's 2nd RFI response.

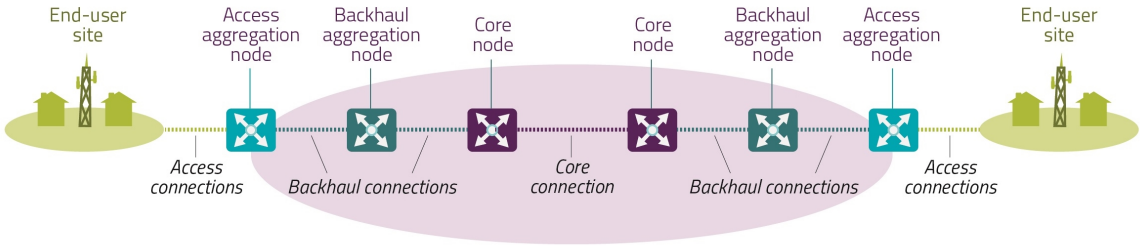
A6.37 Figure A6.8 shows the intended 'Stage 4' end-state for KCOM's access network, one based entirely on all services being delivered over the GPON-based FTTP access network, with the legacy copper network removed.

Leased Lines connectivity

A6.38 When considering leased lines services, access, backhaul, and core connections have different functions and are illustrated in the Figure A6.9 below:

- access connections are typically between end-user sites and an access aggregation node or, in some cases, between end-user customer sites;[39]
- backhaul connections are between access and backhaul nodes, between backhaul nodes (not shown), and from a backhaul aggregation node to a core node;[40] and
- core connections are between core nodes.

Figure A6.9: Access, backhaul, and core connectivity



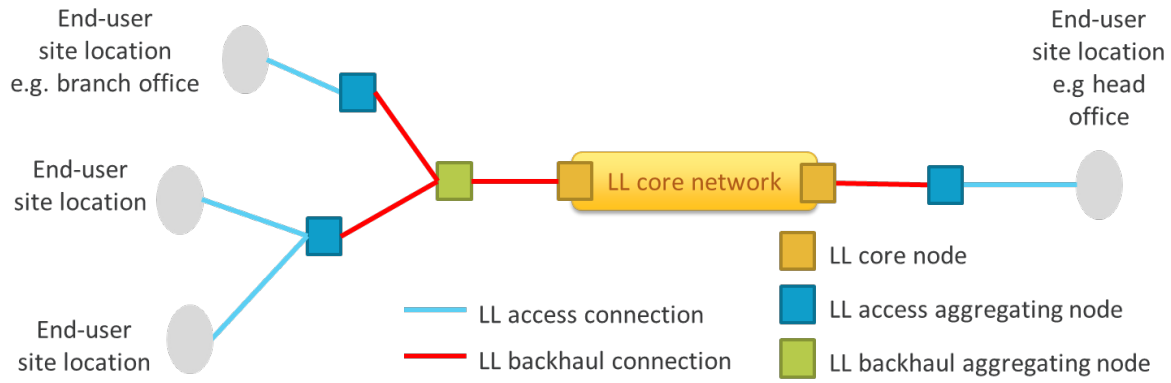
Source: Ofcom.

A6.39 Demand for access services comes from end-users, with a dedicated connection to each end-user site. These can also be referred to as terminating segments.

A6.40 Traditionally, businesses have used leased lines to connect their sites, and sometimes to connect with other businesses, using dedicated connections. A typical end-to-end connectivity arrangement is illustrated in Figure A6.10.

[39] Some networks have small access aggregation nodes between the end-user site and the access aggregation site (such as cabinets with FTTC DSLAMs or a mobile base station with a fixed connection which then uses microwave to connect to additional base stations) or as part of a 'daisy chain' (such as cabinets as part of a ring within the cable access network). We have treated these examples as a part of the access network and not inter-exchange backhaul connections.
[40] Note that in our leased lines regulation as imposed in the 2019 BCMR Statement, we use the term "Backhaul Segment" which is defined as "connecting one operational building of the Dominant Provider to another operational building of the Dominant Provider" and which may include both backhaul and core connections as described in this section.

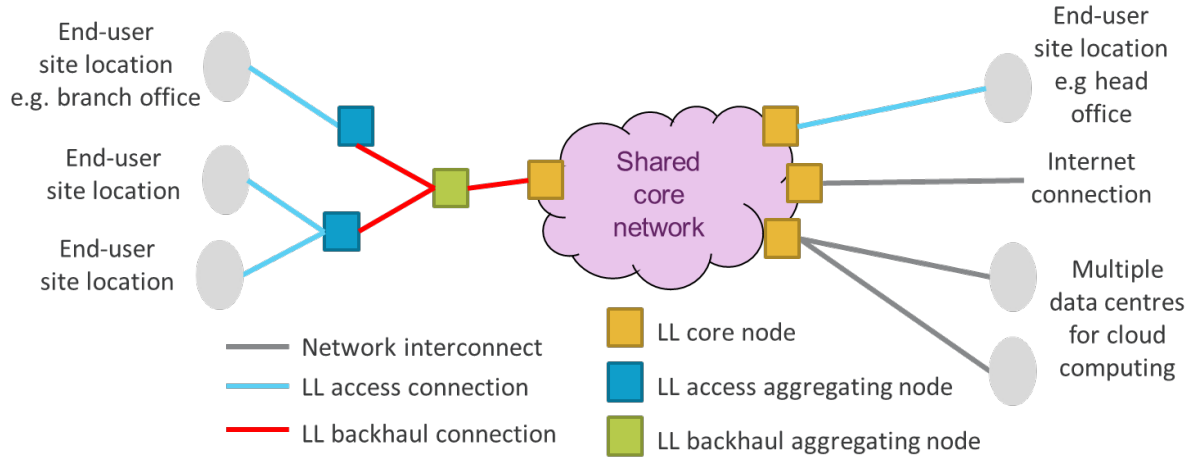
Figure A6.10: Business end-to-end connectivity



Source: Ofcom.

A6.41 This model is becoming less common as it is superseded by VPNs[41] which include connectivity to internet-based services and to outsourced cloud computing services.[42] This is illustrated in Figure A6.11.

Figure A6.11: Business access connectivity (VPN, internet & cloud computing)



Source: Ofcom.

A6.42 Demand for backhaul and core services comes from telecoms providers that need to carry aggregated traffic between BT exchanges, data centres and telecoms provider network nodes. These connections can also be referred to as trunk segments.

A6.43 Data centres are secure buildings that house computing facilities for cloud-based services such as data storage, application hosting, and data processing. Data centres typically house

[41] Virtual private networks (VPNs) are networks that provide any-to-any connection between multiple sites (not just point-to-point). They are private to the customer, unlike the internet which is public. They are provided using communications equipment that is shared between a number of business customers and normally located in a telecoms provider's or systems integrator's premises or a data centre.

[42] Cloud computing is computing capacity, distributed across a number of data centres, that is connected by either a business VPN or networks provided by the data centre operators.

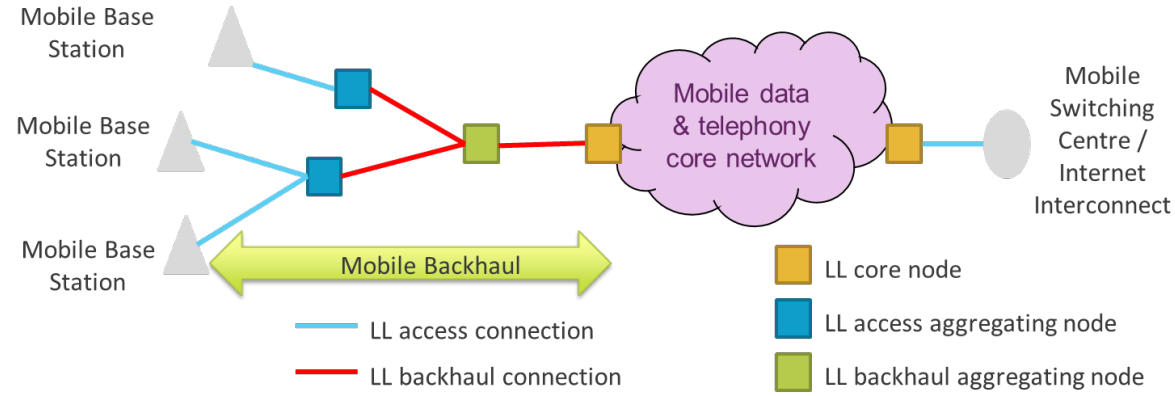
network nodes which can include core and backhaul aggregation and traffic routing functionality as well as being used for interconnection to other networks. They can have multiple tenants and may be owned and operated by telecoms providers or run by third-party providers, in the latter case they are known as 'carrier neutral data centres'.

A6.44 Most data centres require reliable high-capacity connections, often to a number of different telecoms providers, to support a large number of telecoms services and to support multiple end end-user customers across multiple end-user sites.

A6.45 Some data centres may be owned by a single end-user customer, such as a large enterprise, providing services over various connectivity solutions to their own end-user customer sites rather than in a network operator's operational building.

A6.46 Leased lines may also be used by mobile network operators (MNOs) to connect their base stations[43], using access and backhaul connections, to their core network nodes. The term 'mobile backhaul' is often used to refer to the combination of access and backhaul connections between the mobile base station and the mobile core node. MNOs may also use leased lines to provide connectivity between their core sites to construct the networks used to support mobile services including access to the internet and other networks. This is illustrated in Figure A6.12.

Figure A6.12: Mobile network connectivity



Source: Ofcom.

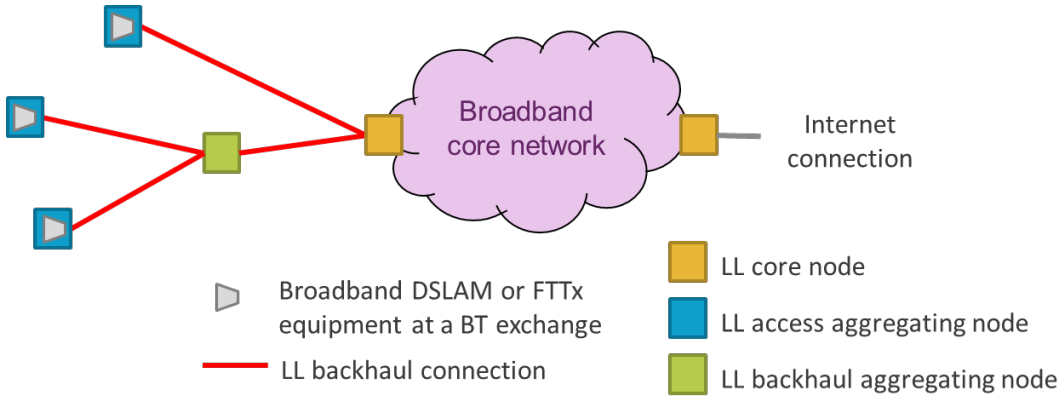
A6.47 Fixed broadband operators can build their own broadband networks using leased lines for backhaul and core connectivity, together with access connections owned and operated by KCOM. In this case, they would site their equipment to connect to KCOM's access network (i.e. their access aggregating node) at a KCOM local exchange. Alternatively, outside of the Hull Area, an operator may choose to build its own access connections (for example Virgin Media's network).

A6.48 Fixed broadband operators use leased lines to connect from their access nodes within local exchanges to their backhaul and core network nodes. These network connections are referred to as 'fixed broadband backhaul'. Fixed broadband operators will also connect to

[43] These are the radio masts that provide the communications between the mobile handset and the fixed mobile network.

the internet at suitable locations to provide an end-to-end broadband service. This is illustrated in Figure A6.13.

Figure A6.13: Broadband network connectivity



Source: Ofcom.

Access, trunk and inter-exchange connectivity

A6.49 In the 2019 BCMR Statement we separated leased lines access and inter-exchange connectivity into separate markets. We have proposed to do the same in our 2020 WFTMR Consultation. This is based on the difference between access (terminating) and trunk connectivity. In general terms, access connectivity connects to an end-user customer location, whereas trunk connectivity connects between telecoms provider nodes and, importantly, aggregates traffic from multiple access connections or services. We are not proposing to identify a separate interexchange market or any other trunk connectivity market in the Hull Area.

A6.50 In some cases, an access circuit may include a segment that runs between telecoms provider nodes. For example, in Figure A6.10 above, we explain end to end business connectivity. The connection between the two end customer locations may be provided through aggregating nodes. But, where this is a single dedicated connection, we consider that the segments between these aggregating nodes should still be considered as part of the access service since these segments are required to provide the service.

A6.51 Where access circuits are provided at the wholesale level, these may run from a retail customer's end location to an aggregation node of the network operator where the telecoms provider purchasing the wholesale service has located its own equipment. This aggregation node may not be the node closest to the retail customer's end location and so the circuit may run through several aggregating nodes. Again, the segments connecting between aggregating nodes needed to provide the single connection form the retail customer's location to the wholesaler's equipment would constitute the access circuit.

A6.52 In terms of other leased lines, we consider mobile backhaul (i.e. connections where one end is the mobile cell site, as per Figure A6.12) has the characteristics of an access circuit. Broadband connectivity (see Figure A6.13), should be considered as a trunk circuit.

Wireless technologies

A6.53 The discussion above relates to networks that provide services at a fixed location using a wired (either copper, coaxial cable or fibre) connection all the way.

A6.54 Services can also be provided using wireless technology: satellite, mobile and fixed wireless access (FWA).

Satellite

A6.55 Satellite coverage is available almost everywhere in the UK, offering an alternative for end-user customers that receive poor broadband, typically those in remote rural areas.

A6.56 Satellite broadband can be offered by either a GEO (geostationary) or a LEO (low earth orbit) satellite. GEO satellites are fixed at a position on the geostationary belt moving with the Earth as it rotates. They are positioned at a very large distance from the Earth, being able to cover large areas. This results in large response times and slow speeds.

A6.57 LEO satellites, on the other hand, are positioned much closer to the Earth, covering smaller areas than the GEO ones and allowing for faster connections. As they are not at a fixed location, a network of hundreds of constantly moving satellites is necessary to provide consistent coverage. In order to track and connect to the best satellite as they move overhead, user terminals require very expensive antennas.

A6.58 Satellite services tend to offer services with lower bandwidth than fixed broadband services. In addition, traditional GEO satellite services have higher latency than fixed broadband services. This could affect some users who have requirements for low latency, e.g. gamers or consumers wishing to make VoIP calls.

A6.59 Performance could be improved with the use of LEO (low earth orbit) satellites. Although not available yet, companies like SpaceX and Telesat plan to launch LEO constellations for commercial broadband as early as this year. In theory, LEO satellites will offer low latency and higher speeds, ranging from 100Mbit/s to gigabits per second.

A6.60 Upfront charges for equipment could be even higher for LEO services, for which affordable user terminals have not been yet produced.

A6.61 Even if the new LEO satellites will be able to deliver increased performance compared to traditional satellite broadband, it is not yet clear whether the price packages will be attractive enough to win end-user customers over from fibre.

Internet access over a mobile network

A6.62 Use of mobile data services is another alternative to fixed broadband. End-user customers in this category can connect to a 4G or 5G mobile network using their mobile phone, a dongle or similar equipment.

A6.63 Whilst very high speeds can be obtained, due to the shared nature of the network and the fact that speed will depend on the quality of signal being received, speeds are likely to be

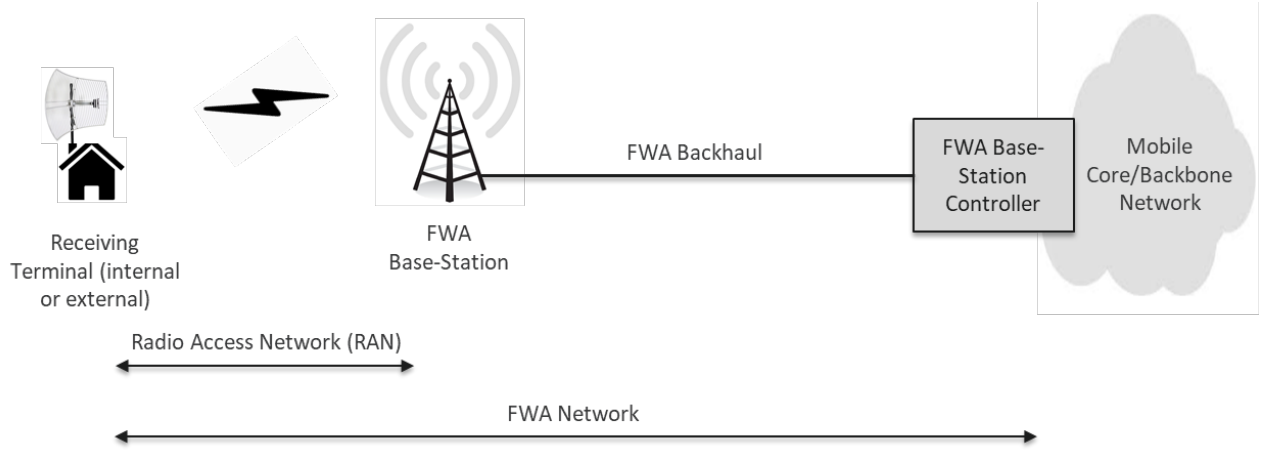
much lower in many cases. On a 4G network, these could typically be around 20Mbit/s on average. On a 5G network, the latest mobile technology that was introduced to the UK earlier in 2019, users may be able to receive higher average speeds of 150Mbit/s.

A6.64 Mobile coverage is another factor that needs to be considered. Although 91% of the UK has good 4G coverage from at least one operator, 5G is not as widespread yet. 5G has been launched by all four main MNOs, however it currently has limited reach, with operators making it available only in select areas of the UK, including within the Hull Area.

Fixed Wireless Access

A6.65 Fixed Wireless Access (FWA) networks use a wireless link for the final connection to an end-user's premises, avoiding the installation of a cable to the building. The link is between the mobile mast and end-user equipment placed in the end-user customer's premises. Depending on the end-user customer's location, an external antenna might need to be installed to achieve connection (Figure A6.14).

Figure A6.14: Typical Fixed Wireless Access network topology



Source: Ofcom.

A6.66 Fixed wireless access services can be grouped into two broad categories depending on the frequencies used:

- services using light-licensed and license-exempt spectrum in the 5GHz band;[44] and
- services using licensed 4G and 5G mobile bands.[45]

A6.67 For the first category speeds vary, with basic packages offering speeds from 10Mbit/s, sometimes up to 60 Mbit/s. Many packages have data caps, although more expensive packages offer higher or unlimited data. As this service operates on licence-exempt and light-licensed frequencies, there can be interference from nearby services operating on the same frequencies. This, along with capacity constraints and line-of-sight issues make it difficult to scale these services.

[44] There are no restrictions on the use of unlicensed spectrum which means that the quality of the connection cannot be guaranteed, due to interference from neighbouring services.
[45] Generally, licensed spectrum bands are allowed to be used only by organisation licensed by Ofcom.

A6.68 The second type of FWA uses access to 4G and the newer 5G networks. This service shares many of the characteristics of mobile broadband, but is optimised for home usage by, for example, locating end-user customer modems in optimal locations in end-user customer premises. As discussed for mobile, depending on traffic and capacity in the network, speeds can vary and are around 20Mbit/s for 4G and 150Mbit/s for 5G for an average user experience.

A7. Physical infrastructure access

A7.1 The 2014 EC Recommendation sets out those product and service markets which, at a European level, the Commission has identified as being susceptible to *ex ante* regulation. Physical infrastructure access is not a recommended market. However, regulated access to physical infrastructure is increasingly being used to accelerate network development in the rest of the UK consistent with the objectives in our Strategic Review of Digital Communications (DCR).[46] The Government also designated its Strategic Statement of Priorities (SSP) for telecommunications, the management of radio spectrum, and postal services in October 2019 which included developments for full-fibre connectivity.[47]

A7.2 We have therefore carefully considered whether it would be appropriate for us to review the physical infrastructure market in the Hull Area. We do not consider it appropriate at this stage.

A7.3 To date, the principal challenge in relation to competition in the Hull Area has been the lack of scale entry at any level of the value chain. We do not believe that lack of access to KCOM's poles and ducts is the reason for the lack of competition. Unlike BT in the rest of the UK, KCOM has already invested in a full-coverage FTTP network across the whole of the Hull Area and larger scale network providers have told us that the existence of a full-coverage FTTP network is a factor that would count against investment in a rival network in the Hull Area.[48] KCOM's almost complete share of the residential retail market provides a significant barrier for a rival network to obtain enough customers to develop an alternative network.

[46] Ofcom, February 2016. Strategic Review of Digital Communications.
[47] DCMS, October 2019. Statement of Strategic Priorities for telecommunications, the management of radio spectrum, and postal services.
[48] CityFibre's 1st RFI response, and call between Ofcom and [✂], 3 March 2020.

A8. Glossary

Term	Description
2014 EC Recommendation	The 2014 EC Recommendation on relevant product and service markets.
2017 NMR Statement	The 2017 Narrowband Market Review Statement.
2018 WLA/WBA Statement	The 2018 Wholesale Local Access and Wholesale Broadband Access Market Reviews Statement.
2019 BCMR Statement	The 2019 Business Connectivity Market Review Statement.
2019 PIMR Statement	The 2019 Physical Infrastructure Market Review Statement.
2020 WFTMR Consultation	The 2020 Wholesale Fixed Telecoms Market Review Consultation.
5G	The term used to describe the next generation of wireless networks beyond 4G LTE mobile networks. 5G is expected to deliver faster data rates and better user experience.
Access Charge Change Notice (ACCN)	A contractual notification of a change to the price of a regulated network access service issued by the incumbent provider.
Active leased lines	Permanently connected communications links between two sites, dedicated to the customers' exclusive use, and provided with active electronics at either end of the connection.
AFI (Additional Financial Information)	Detailed financial information provided in confidence to Ofcom as part of KCOM's Regulatory Financial Statements.
All providers' 1st RFI response	All providers' responses to Ofcom's 1st information requests sent pursuant to s135 Communications Act 2003. All providers refers to: CityFibre Infrastructure Holdings Limited; Connexin Limited; [✂]; [✂]; KCOM Group Limited; MS3 Networks Limited; Pure Broadband Limited; [✂]; [✂]; [✂]; [✂].
ATA (Analogue Telephone Adapter)	A piece of equipment that allows standard analogue telephone equipment to be used with a VoIP network.
Backhaul	Transmission links, typically between access and core elements within a network.
Bandwidth	The rate at which data can be transmitted. Usually expressed in bits per second (bit/s).

Bearer	A transmission link that carries one or more multiplexed smaller capacity connections.
BEREC	Body of European Regulators for Electronic Communications.
BoR	Board of Regulators which is part of BEREC, and is sometimes used when referring to BEREC documents in the form, for example, BoR (12)
BT	British Telecommunications plc.
CCA (Current Cost Accounting)	An accounting convention, where assets are valued and depreciated according to their current replacement cost while maintaining the operating or financial capital of the business entity.
CI (Contemporary Interface)	A set of modern technologies used for delivery of leased lines services (e.g. Ethernet or wavelength-division multiplexing).
CISBO (Contemporary Interface Symmetric Broadband Origination)	A service defined in the 2016 BCMR consisting of wholesale leased lines services using CI technologies.
CityFibre's 1st RFI response	CityFibre Infrastructure Holdings Limited's response dated 21 February 2020 to Ofcom's 1st information request sent pursuant to s135 Communications Act 2003, dated 31 January 2020.
Co-location	The provision of space and associated facilities at a KCOM exchange for the hosting of telecom provider equipment.
Connexin's 1st RFI response	Connexin Limited's response dated 19 February 2020 to Ofcom's 1st information request sent pursuant to s135 Communications Act 2003, dated 29 January 2020.
CPE (Customer Premises Equipment)	Sometimes referred to as customer apparatus or consumer equipment. Equipment on consumers' premises which is not part of the public telecommunications network but is directly or indirectly attached to it via network terminating equipment (NTE).
CRF (Common Regulatory Framework)	The European Union harmonised framework for the regulation of electronic communications by Member States.
[✂]	[✂]
DC (Data Centre)	Premises whose main purpose is to house computing, data and application hosting, and communications equipment. They tend to have multiple tenants and may be owned and operated by carriers and/or run by third party providers that

	are carrier neutral. A carrier neutral data centre is owned and operated entirely independently of network providers and allows interconnection to and between multiple telecoms providers.
DCMS	Department for Digital, Culture, Media and Sport
DCR	Strategic Review of Digital Communications
Dark fibre	A service which allows telecoms providers to lease only the fibre element of leased lines from a supplier, allowing them to attach equipment of their own choosing at either end to 'light' the fibre and use it as the basis for offering a range of leased lines products.
Distribution point	A flexibility point in KCOM's access network to which final connections to customer premises are connected. Usually either an underground joint or a connection point on a pole where dropwires are terminated.
Duct and pole access	A wholesale access service allowing a telecoms provider to make use of the underground duct network and the poles of another telecoms provider.
DSL (Digital Subscriber Line)	A family of technologies generically referred to as DSL or xDSL that enable the transmission of broadband signals over ordinary copper telephone lines. ADSL, HDSL (High bit rate Digital Subscriber Line) and VDSL (Very high data rate Digital Subscriber Line) are all variants of xDSL.
EC	The European Commission.
EC SMP Guidelines	The European Commission's guidelines to national regulatory authorities (NRAs) on the market analysis and assessment of significant market power (SMP).
ECAS	KCOM's Ethernet Connect Access Service which comprises Ethernet point to point data circuits (similar to EDAS service but permitted for use where there is onward connection to a point outside of the Hull Area).
Excess construction charges	A charge levied by KCOM where additional construction of duct and fibre or copper is required to provide service to customer site.
EDAS	KCOM's Ethernet Direct Access Service which comprises Ethernet point to point data circuits
EECC (European Electronic Communications Code)	The European Union's regulatory framework for electronic communications.

EOI (Equivalence of Input)	A remedy designed to prevent a vertically-integrated company from discriminating between its competitors and its own business in providing upstream inputs.
Ethernet	A frame-based technology originally developed for use in Local Area Networks (LANs) but now also widely used in telecoms providers' networks for the transmission of data services.
[✂]	[✂]
Exchange	The KCOM telephone exchange, to which customers are directly connected.
FAC (Fully Allocated Cost)	An accounting approach under which all the costs of the company are distributed between its various products and services. The fully allocated cost of a product or service may therefore include some common costs that are not directly attributable to the service.
FTTC (Fibre-to-the-Cabinet)	An access network structure in which the optical fibre extends from the exchange to the street cabinet. The street cabinet is usually located only a few hundred metres from the subscriber's premises. The remaining part of the access network from the cabinet to the customer is usually copper wire but could use another technology, such as wireless.
FTTP (Fibre-to-the-Premises)	An access network structure in which the optical fibre network runs from the local exchange to the end-user's house or business premises. The optical fibre may be point-to-point (there is one dedicated fibre connection for each home) or may use a shared infrastructure such as a GPON. Sometimes also referred to as Fibre-to-the-home (FTTH), Fibre-to-the-Business (FTTB) or full-fibre.
FWA (Fixed Wireless Access)	An access service where the connection between the network and the equipment located at the customer premises is provided over the radio access medium.
Gbit/s	Gigabits per second (1 Gigabit = 1,000,000,000 bits). A measure of bandwidth in a digital system.
GEA (Generic Ethernet Access)	Openreach's wholesale service providing telecoms providers with access to its FTTC and FTTP networks to supply higher speed broadband services. The GEA service meets BT's obligation to provide VULA.
GPON (Gigabit Passive Optical Network)	A shared FTTP network technology that can be used for NGA.

Hull Area	The area defined as the 'Licensed Area' in the licence granted on 30 November 1987 by the Secretary of State under section 7 of the Telecommunications Act 1984 to Kingston upon Hull City Council and Kingston Communications (Hull) plc (KCOM).
ISDN (Integrated Services Digital Network)	A digital telephone service that supports telephone and switched data services.
kbit/s	Kilobits per second (1 kilobit = 1,000 bits). A measure of bandwidth in a digital system.
KCOM	KCOM Group Limited
KCOM's 1st RFI response	KCOM Group Limited's response dated 27 January 2020 and 3 February 2020 to Ofcom's 1st information request sent pursuant to s135 Communications Act 2003, dated 8 January 2020.
KCOM's 2nd RFI response	KCOM Group Limited's response dated 30 June 2020 to Ofcom's 2nd information request sent pursuant to s135 Communications Act 2003, dated 22 June 2020.
KLR (KCOM Line Rental)	A line rental product covering analogue lines, ISDN2 and ISDN30.
KPIs (Key Performance Indicators)	Specified information to be provided for the purposes of assessing performance and providing transparency of service provision by a dominant provider.
Latency	A measure of delay in transmission over a transmission path.
Lead-in	The final section of a physical infrastructure network, housing the connection between the distribution point and the Customer's Premises Equipment.
Leased lines	Permanently connected communications links between two sites dedicated to the customers' exclusive use.
LEO (low earth orbit) satellites	A new form of satellite technology that relies on networks of many satellites which are positioned much closer to the earth than traditional geostationary satellites and may therefore offer lower latency and higher speeds for broadband services.
LL Access	Means wholesale leased lines access services.
LLU (Local Loop Unbundling)	A process by which a dominant provider's local loops are physically disconnected from its network and connected to competing providers' networks. This enables operators

	other than the incumbent to use the local loop to provide services directly to customers.
Mbit/s	Megabits per second (1 Megabit = 1 million bits). A measure of bandwidth in a digital system.
MCE (Mean Capital Employed)	KCOM's definition of Mean Capital Employed is total assets less current liabilities, excluding corporate taxes and dividends payable, and provisions other than those for deferred taxation. The mean is computed from the start and end values for the period, except in the case of short-term investments and borrowings, where daily averages are used in their place.
MNO (Mobile Network Operator)	A provider which owns a cellular mobile network.
Modified Greenfield Approach	An approach to analysing markets, where we consider a hypothetical scenario in which there are no *ex ante* SMP remedies in the market being considered or in any markets downstream of it.
MPF (Metallic Path Facility)	The provision of access to the copper wires from the customer site to a KCOM MDF that covers the full available frequency range, including both narrowband and broadband channels, allowing a competing provider to provide the customer with both voice and/or data services over such copper wires.
MS3's 1st RFI response	MS3 Networks Limited's response dated 20 February 2020 to Ofcom's 1st information request sent pursuant to s135 Communications Act 2003, dated 31 January 2020.
NCA (Net Current Assets)	A measure of the amount of capital being used in day-to-day activities by the company. It is equal to current assets less current liabilities.
NICC	A technical forum for the UK communications sector that develops interoperability standards for public communications networks and services in the UK. It is an independent organisation owned and run by its members. Ofcom participates in NICC as an observer.
NRA	National Regulatory Authority.
ODF Site	The site of an operational building of the provider with Significant Market Power that houses an optical distribution frame.
Openreach Division	The line of business of BT which comprises BT's access and backhaul network assets and the products and services

	provided using those assets and which Openreach Limited, a wholly owned subsidiary of BT plc, has responsibility for operating and managing on behalf of BT.
PIA (Physical Infrastructure Access)	A remedy requiring KCOM to provide telecoms providers with access to its physical infrastructure (i.e. ducts and poles).
POH (Point of Handover)	A point (location) where one telecoms provider interconnects with another telecoms provider for the purposes of connecting its networks to 3rd party customers to provide services to those end customers. May also be referred to as point of connection (POC).
PON (Passive Optical Network)	A point to multipoint fibre-optic network architecture that uses passive optical splitters.
Point of presence (PoP)	A node in a telecoms provider's network (such as an exchange or other operational building), generally one used to serve customers in a particular locality.
PSTN (Public Switch Telephony Network)	The telephony network used to provide telephone calls using (or emulating) circuit-switching and using telephone numbers to identify subscribers or called locations, allowing all customers connection to the network to call all other customers.
PTR (Pricing Transparency Report)	A report detailing the charges that a telecoms provider makes to its customers for certain services.
Pure Broadband's 1st RFI response	Pure Broadband Limited's response dated 14 February 2020 to Ofcom's 1st information request sent pursuant to s135 Communications Act 2003, dated 29 January 2020.
QoS (Quality of Service) standards	The level of provisioning and fault repair QoS performance standards that we have set KCOM to meet.
[✂]	[✂]
Resellers	Resellers are telecoms providers that buy retail-minus products from KCOM and resell these products under a white-label arrangement, predominantly to business customers. Resellers provide aspects such as billing and customer service, but do not provide any technical elements.

RFS (Regulatory Financial Statements)	The financial statements that KCOM is required to prepare by Ofcom. They include the published RFS and AFI provided to Ofcom in confidence.[49]
[✂]	[✂]
RO (Reference Offer)	A document or set of documents published by a telecoms provider setting out matters such as the product definition, technical specifications, the terms and conditions for provisioning, SLAs and SLGs, and availability of other related services such as accommodation.
RoUK (Rest of the UK)	A geographic market set out in the 2016 BCMR, consisting of an area outside the Central London Area, Central Business Districts, and the Hull Area.
SLA (Service Level Agreement)	A contractual commitment provided by KCOM to telecoms providers about service standards.
SLG (Service Level Guarantee)	A contractual commitment by KCOM to telecoms providers specifying the amount of compensation payable by KCOM to a telecoms provider for a failure to adhere to an SLA.
SLU (Sub-Loop Unbundling)	Like local loop unbundling (LLU), except that telecoms providers interconnect at a point between the exchange and the customer, usually at the cabinet.
SMP (Significant Market Power)	The significant market power test is set out in European Directives. It is used by National Regulatory Authorities (NRAs), such as Ofcom, to identify those telecoms providers which could act, to an appreciable extent, independently of the market in order to determine of additional obligations should be imposed on them under the relevant Directives.
SOGEA (Single Order Genetic Ethernet Access)	SOGEA enables the provision of wholesale superfast broadband without the need for WLR or MFP to support it.
SoR (Statement of Requirement)	A KCOM process for submission and processing of requests for product/service enhancements.
SSNIP (Small but Significant Non-transitory Increase in Price) Test	An element of the hypothetical monopolist test used in market definition analysis, in which the competitive constraints posed by potential substitutes for the service in question are tested by considering switching to the substitutes if the price of the service was increased by a small but significant non-transitory amount (often 5 to 10 per cent).

[49] KCOM, *KCOM Regulatory accounts*, [Accessed 8 July 2020].

SSP	Strategic Statement of Priorities for telecommunications, the management of radio spectrum, and postal services
TDM (Time Division Multiplexing)	A method of combining multiple data channels for transmission over a shared transmission path by means of time-sharing. The multiplexor shares the transmission path by repeatedly allowing each data channel in turn to transmit data for a short period. PDH and SDH are examples of transmission systems that employ TDM.
Telecoms provider	An organisation which provides an electronic communications network or provides an electronic communications service.
The Act	The Communications Act 2003.
[✂]	[✂]
Third Party	A person, other than KCOM, providing a public electronic communications service or a person providing a public electronic communications network
TI (Traditional interface)	Traditional interface leased line. Leased lines which use legacy analogue interface or digital time-division multiplex (TDM) interfaces.
VoIP (Voice Over Internet Protocol)	A technology for encoding and transmitting voice calls over IP fixed and mobile networks.
VPN (Virtual Private Network)	A technology allowing users to make inter-site connections over a public telecommunications network that is software partitioned to emulate the service offered by a physically distinct private network.
VULA (Virtual Unbundled Local Access)	A regulatory obligation requiring KCOM to provide access to its FTTC and FTTP network deployments which allows telecoms providers to connect at a local aggregation point and are provided a virtual connection from this point to the customer premises.
WBA (Wholesale Broadband Access) market	The WBA market concerns the wholesale broadband products that telecoms providers provide for themselves and sell to each other.
WCO (Wholesale Call Origination)	Wholesale fixed call origination services.
WDM (Wavelength Division Multiplex)	An optical frequency division multiplexing transmission technology that enables multiple high capacity circuits, to share an optical fibre pair by modulating each on a different optical wavelength.

WFAEL (Wholesale Fixed Analogue Exchange Lines)	A narrowband analogue access connection between a customer's premises and a local exchange.
WFLLA (Wholesale FibreLine Local Access)	KCOM fibre-based wholesale line access service.
WISP (Wireless Internet Service Provider)	WISPs use unlicensed/lightly licensed spectrum to deliver a wireless broadband connection to a fixed location.
[✂]	[✂]
WLA (Wholesale Local Access)	The provision of broadband and telephony services at a fixed location from a point of aggregation of subscriber connections to a home or business premises.

A9. Sources of evidence

A9.1 We have noted throughout this consultation the external evidence we have collected to inform our analysis and how we have relied upon that evidence. This annex provides a list of the main sources of external evidence used and, where possible, the web links to where that information is published online.

A9.2 While this annex lists the main evidence we have relied upon, the list is for convenience only and is not intended to be exhaustive.

UK legislation

- The Communications Act 2003 (the Act), as amended.

Ofcom documents

- Ofcom, February 2016. Strategic Review of Digital Communications.
- Ofcom, November 2017. Narrowband Market Review: Statement.
- Ofcom, July 2018. Wholesale Local Access and Wholesale Broadband Access Market Reviews: Statement.
- Ofcom, February 2019. KCOM Regulatory Financial Reporting: Statement.
- Ofcom, May 2019. Helping consumers get better deals: Statement and Annex 4.
- Ofcom, June 2019. Business Connectivity Market Review: Statement and Annex 6.
- Ofcom, September 2019. Connected Nations Update: Summer 2019.
- Ofcom, December 2019. Connected Nations 2019: Report.
- Ofcom, January 2020. Wholesale Fixed Telecoms Market Review 2021-26: Consultation.
- Ofcom, April 2020. Ofcom's Plan of Work 2020/21.
- Ofcom, June 2020. Proposed Consent for KCOM to defer its 2019/20 and 2020/21 Regulatory Financial Statements: Consultation.

Ofcom research

- Ofcom Nations and Regions Technology Tracker – H1 2017. 3 January to 28 February 2017.
- Ofcom Nations and Regions Technology Tracker – 2020. 9 January to 7 March 2020.
- Ofcom, December 2019. Connection Nations 2019 data downloads and data on fixed local unitary authority.

Ofcom website

- Ofcom, April 2020. How broadband and mobile firms are serving customers during the coronavirus pandemic.

European Commission legislation and guidance

- Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities.
- Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services.
- Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services.
- Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services.
- Commission Recommendation of 19 September 2005 on accounting separation and cost accounting systems under the regulatory framework for electronic communications (2005/698/EC).
- Commission Recommendation of 11 September 2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment (2013/466/EU).
- Commission Recommendation of 9 October 2014 on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services (2014/710/EU).
- Guidelines on market analysis and the assessment of significant market power under the EU regulatory framework for electronic communications networks and services (2018/C 159/01).

Other sources

BEREC

- BEREC, 2012. BEREC Common Position on best practice in remedies imposed as a consequence of a position of significant market power in the relevant markets for wholesale leased lines.
- BEREC, 2012. BEREC Common Position on best practice in remedies on the market for wholesale (physical) network infrastructure access (including shared or fully unbundled access) at a fixed location imposed as a consequence of a position of significant market power in the relevant market.
- Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators of Electronic Communications (BEREC) and the Office (the BEREC Regulation).

Government

- Department for Digital, Culture, Media and Sport, 16 July 2019. Implementing the European Electronic Communications Code.
- Department for Digital, Culture, Media and Sport, 29 October 2019. Statement of Strategic Priorities for telecommunications, the management of radio spectrum, and postal services.

London Stock Exchange

- London Stock Exchange, 2019. Recommended Cash Offer for KCOM Group Plc.

Other websites

BT

- BT Consumer Price Guide.
- Financial reporting & news: Annual Review 2020.
- Landline deals.
- Managing your budget.

CityFibre

- CityFibre, 2014. CityFibre signs 'dark fibre' deals with EE and Three to enhance mobile networks.
- CityFibre, 2017. Vodafone and CityFibre bring gigabit-speed fibre to the UK.

Connexin

- Connexin Home: Our packages.

Digital TV Europe

- Digital TV Europe, 2020. CityFibre announces restructured Vodafone deal.

EE

- Pay monthly mobile broadband devices.

KCOM

- Ethernet Connect Access Service.
- Ethernet Direct Access Service.
- Description of Cost Accounting System (DOCAS): Representing the Primary and Secondary Accounting Statement Together with Wholesale and Retail Catalogues.
- KCOM Group PLC Regulatory Financial Statements for the year ended 31 March 2019.
- Keeping you connected – message from KCOM Chief Executive Officer Dale Raneberg.
- Previous strategic IT development notices.
- Products: calls.

- Products: Lightstream.
- Reference Offer for the Provision of Accommodation Services, Schedule 1: Definitions.
- Reference Offer Wholesale FibreLine Local Access, Schedule 2: WFLLA CableConnect Service.
- Wholesale FibreLine Local Access Price List.

Macquarie

- Macquarie, 2019. Macquarie Infrastructure and Real Assets finalises acquisition of KCOM Group.

Openreach

- Superfast and Ultrafast Fibre Access price list.
- Ethernet services price list.
- Dark fibre price list.

Post Office

- Home phone deals.

Pure Broadband

- PureHome broadband packages.

Three

- 4G home broadband packages.

Vodafone

- 5G GigaCube home broadband packages.

Wisper

- Wisper Broadband internet packages.