Vodafone's response to Ofcom's business connectivity market review and leased line charge control.

Executive summary

Vodafone welcomes the opportunity to respond to these two very important consultations. It limits its comments here to particular issues which impact its mobile business. Separate comments will be submitted by Cable and Wireless Worldwide ("C&WW").

Vodafone supports a number of Ofcom's conclusions and proposals, namely:

- A recognition that demand for Ethernet links is likely to grow strongly in the future leading to a significant reduction in unit costs;
- Ensuring existing RBS links are covered by the TI price cap;
- A reduction in the prices for digging and other ancillary services which Vodafone has long considered to be excessive;
- A specific price-cap on backhaul services to prevent BT from focussing its cuts on non-mobile services.

However, Vodafone believes that Ofcom is letting slip an important opportunity to kick-start broadband investment and coverage. Only by opening up access to BT's physical infrastructure (PIA) can Ofcom create the stepchange in conditions to ensure ubiquitous high-speed and rich data coverage. As long as the regulated costs of bandwidth remain broadly linear to scale (because BT recovers a far larger proportion of common costs from high bandwidth services) rather than reflecting the underlying cost structure, which is that there are very low marginal costs incurred in the provision of additional bandwidth for an established route, this will not happen. Vodafone believes that opening PIA for all purposes, but in particular for mobile backhaul,and thus opening up significant competition in link provision, is the best way of achieving Ofcom's and the UK Government's policy objectives.

Vodafone also believes that Ofcom needs to focus further on ensuring that cost effective and workable migration products are made available by Openreach. A multi-hour outage during any transition period is simply not workable in relation to most of these services (and in particular to mobile backhaul) and therefore, the costs of a full disconnection coupled with the overlapping provision of a new link act as a considerable barrier to switching and to an efficient market.

Mobile backhaul is potentially a bottleneck to the supply of mobile services

There is a significant risk that that the provision of backhaul links between the cell sites and the core network of a mobile operator could become a bottleneck in the delivery of mobile services, particularly of data, in the next few years. Ofcom's recent consultation on the potential release of 700MHz spectrum brings this point out very

clearly. In that consultation Ofcom envisaged a very significant increase in demand for mobile data and that:

> "*Meeting this growth in demand could deliver significant benefits to citizens and consumers by:*
>
> - *Enabling the future delivery of higher capacity mobile services, supporting further innovation in mobile applications;*
> - *Ensuring that the UK's mobile infrastructure is capable of supporting future growth in the wider economy; and*
> - *Enabling the future delivery of next generation video and data based emergency service applications.*[1]*"*

Ofcom entertained three scenarios of growth in mobile data; low, medium and high. "Under a mid-level growth scenario, mobile data capacity demand will experience an 80 fold increase between 2012 and 2030, and a 300 fold increase under a high-growth scenario[2]". To meet the anticipated growth Ofcom considered that mobile operators could use"*a range of different approaches to increase the capacity of their networks. These include:*

- *Using more high and low frequency spectrum. We estimate this could provide between a 7 and 13 times increase in mobile data capacity by 2030;*
- *Upgrading existing mobile networks to more efficient mobile broadband technologies, including LTE (Long Term Evolution). We estimate this could provide between a 3 and 10 times increase in mobile data capacity by 2030;*
- *Offloading mobile data onto fixed networks using Wi-Fi and Femtocells. We estimate that this could serve over half of the predicted increased demand for mobile data capacity; and*
- *Building more mobile sites. This tends to be a higher cost option for mobile operators and can be constrained by the need to secure planning consent for new sites*"[3].

Ofcom then considered in paragraph 1.12 that:

> *"the use of additional mobile broadband spectrum can play a special role in reducing the number of new mobile sites that need to be built, reducing network deployment costs and the need to secure planning consent for a large number of new sites*".

In effect therefore the principal approach of the consultation was to explore the ways in which the anticipated increase in demand for mobile data could be accommodated without the need for additional cell site construction – inevitably therefore this will increase the traffic load at any given cell site and thus also increase the required backhaul capacity from that site to the core network. The first two approaches listed above suggest the likelihood of between a 7*3 and 13*10 or a 21 to 130 times

[1] Securing long term benefits from scarce spectrum resources - A strategy for UHF bands IV and V – Ofcom consultation March 2012 at paragraph 1.9
[2] Consultation at paragraph 1.8
[3] Consultation at paragraph 1.10

increase in the traffic throughput of an individual cell site, by the use of a large bandwidth of spectrum operating under LTE-Advanced, using MIMO antenna technology, improved efficiency modulation and coding technologies, aggregation in future mobile handsets of capacity provided by different frequency bands, joint processing of mobile signals from different mobile sites, and so forth.

It is obvious however that the effectiveness of such increases in individual cell site traffic throughput will be entirely diluted if backhaul from each cell site to the core network is allowed to become a bottleneck. What needs to occur in parallel with the improvements in cell site throughput is a similar step change in the provision of backhaul links in terms of both capacity and cost per unit of capacity. There is no fundamental technical reason why fibre links cannot provide this required capacity at a cost to the network operator that does not scale linearly with traffic throughput.

There are two complementary ways in which this link provision needs to happen: a restructuring of the pricing of leased Ethernet to better reflect the underlying cost structure, and by allowing the self-supply or the use of an alternative wholesaler of such links (the PIA route).

Importance of unlocking mobile network investment

The importance of increasing broadband coverage to as many people as possible cannot be overstated. It is not only extremely important for social reasons but more connectivity also means more economic growth. A recent report commissioned by Vodafone by the research consultancy AT Kearney[4] found that the UK internet economy is worth £82 billion per year. Mobile connections make up 16% of this contribution, and every £1 spent on internet connectivity (both fixed and mobile) generates £5 of revenue for the wider UK ecosystem.

The economic case for extending broadband is therefore not in question. And neither, we believe, is the case that mobile must form an essential part of that. Any broadband solution that can keep pace with the way consumers and businesses access the internet must involve a mix of both fixed-line and mobile broadband. Vodafone notes that this conclusion is echoed by the recent House of Lords Broadband Report.[5]

The need for high capacity backhaul de-linked from traffic growth

However, this increasing demand for bandwidth is not matched by UK consumers' ability or willingness to pay for additional bandwidth at the same rate. The only answer is to decouple transmission costs from traffic growth, in line with the underlying cost structure, as outlined in figure 1 below.

[4] See http://www.atkearney.com/index.php/Publications/the-internet-economy-in-the-united-kingdom.html)

[5] http://www.parliament.uk/business/committees/committees-a-z/lords-select/communications-committee/news/governments-broadband-strategy-risks-leaving-communities-behind/ at paragraph 24 "There is also a role for wireless technologies which can be used as an alternative to copper or fibre for the final link to the premises."

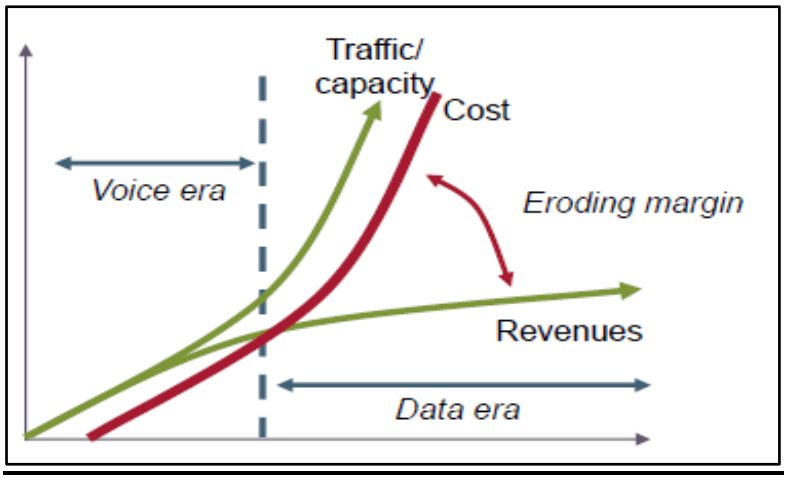


Figure 1: Illustrative relationship between traffic volumes and costs and revenues

Ofcom acknowledges this concern in its consultation at paragraphs 8.80 and following of the BCMR but offers no effective relief to operators. Vodafone accepts that advances in microwave and xDSL copper technologies will offer alternative transport methods in some areas: but each of these has their own capacity limitation. High capacity fibre is the strategic long-term solution for much of a mobile operator's backhaul network.

Ofcom considers in paragraph 8.66 that MNOs are likely to require links "of 100Mbit/s or 1Gbit/s". In Vodafone's view this is not correct in the medium or long term – links of greater capacity are likely to be required, both for the last mile and deeper into the backhaul network.Figure 2 below plots the likely cell site air interface throughput increase over the next few years, and the resultant backhaul requirements, both in the last mile and in the feeders to the core.✂ This however takes no account of any further future release of spectrum beyond the upcoming Combined Auction.

✂

Figure 2: cell site and backhaul traffic requirements

With respect to the costs of such links, Vodafone has calculated the 10 year capex and opex costs of a single BT 1Gbit/s Ethernet link assuming installation in 2013/14 using the prices from the presently proposed charge control, with flat opex prices thereafter[6], together with an estimate of the cost of providing a similar link by means of PIA Duct, ✂

Figure 3 below showsthe present value costs in 2013/14 for such links.

✂

Figure 3 – 2013/14 present value costs of single links, Ethernet and PIA

[6] ✂

There are clearly two important differences between the two link types:

- The leased links exhibit a low capex and high opex structure[7] and the PIA link the exact reverse – this latter more closely approximates the real cost of providing a fibre link, in that the capital costs of such a link are relatively high, but their associated opex is relatively small;

- The PIA link is significantly cheaper than any leased link requiring a main link, even when considered over the limited period of 10 years (an unrealistically short period for the retention of a cell site or the life of the fibre).

But it is clear from figure 2above that a single 1Gbit/s link will provide insufficient capacity as traffic volumes rise, with respect to both the last mile to the site and for aggregated routes closer to the core (depending upon the topology of the backhaul network). Figure 4 below anticipates for illustration a position where a particular route requires between 2-3Gbit/scapacity. Here under the current pricing structure, the only recourse for supplying the capacity by leased Ethernet would be to procure three links, whereas an existing PIA duct is likely to be able to accommodate this additional traffic with no real additional cost. The leased line wholesale cost structure under rising demand thus bears no relationship to mobile data revenue structures or to the underlying cost structure of link provision.

✂

Figure 4 – 2013/14 present value costs of links to supply 2-3Gbit/s, Ethernet and PIA

The cost advantage of the PIA based link under the conditions of rising demand that Ofcom itself anticipates in the 700MHz consultation and elsewhere is overwhelmingly clear. As a result, as welcome as the proposed reduction in regulated Ethernet prices is, it does not solve the underlying problem of separating likely mobile operator operating costs from BT's true underlying costs and from customers' willingness to pay.

The only way therefore that it is viable for mobile sites with a high traffic throughput to be economically supplied with backhaul is if MNOs face the same flat cost curve that is experienced by BT. ✂

Vodafone's experience of PIA in ✂

✂

[7] For simplicity we have described the components of the lease line cost as "capex" and "opex" when in reality they are merely the way that BT has chosen to structure its prices into a one-off initial charge and an annual on-going charge. This is not necessarily reflective of BT's own underlying capex/opex costs of the provision of such a link.

The extension of the allowed use of PIA to support investment in mobile broadband

Ofcom makes the point in 8.62 that:

> *"While current regulations continue to apply to existing services, the opportunity for BT's competitors to use a passive remedy could be most attractive when delivering high-bandwidth services, not because those competitors could necessarily do so more efficiently than BT, but because of the way that BT had decided to recover its common costs."*

We agree – this is entirely the point. The current pricing policy of BT with a low initial chargebut a high on-going annual charge, and prices scaled to bandwidth bears no relation to the underlying costs of provision, and is an inhibitor to the future deployment of mobile broadband.

The necessary flat cost curve could be achieved by changing the structure of Ethernet prices, the use of long lease dark fibre, and by PIA. Vodafone sees these solutions as complementary, rather than mutually exclusivesince this will add to the level of competition for such links enabling the development of a more cost reflective pricing structure for each solution, and thus consequently removing the potential bottleneck to the supply of high capacity backhaul services for mobile operators.

The House of Lords Report

In the consultation, Ofcom has concluded that PIA should not be extended. The House of Lords considered carefully Ofcom's reasoning for not widening PIA for other usesand disagreed:

> *"In our view, these arguments are understandable, but not persuasive. Underthe Communications Act 2003, which implements the EU telecoms package,Ofcom is generally bound to duties both to promote competition and topromote investment, and in particular in so doing, to secure "the availabilitythroughout the UK of a wide range of electronic communicationsservices."*[8]

Vodafone concurs. Ofcom is, in our view, preventing otherwise efficient investment by both mobile operators and potential wholesalers of PIA to mobile operators.

The House of Lords has called for a more holistic approach to the issue:

> *"Ofcom's competition-based regulatory mechanism has led it to a logically sophisticated segmentation and sub-division of the broadband market, while its duties to promote investment would, on the evidence, appear to suggest that a more open field is what is required… Its regulatory edifice is not to be preserved for its own sake, and where a conflict emerges between its existing remedies to promote competition and those it might draw on to promote investment, it may be*

[8] House of Lords Broadband Report at paragraph 228.

that a root-and-branch reconsideration of the relationship between the two and of the entire framework is required. This is not an easy job, but it is Ofcom's responsibility and it could lead to a clearer, more coherent vision of the total market."[9]

Ofcom's reasons for refusing to widen the scope of PIA

Like the House of Lords Report, Vodafone can understand, but is not persuaded by Ofcom's reasons for refusing to mandate PIA for other uses. Upon examination, Vodafone believes that Ofcom's reasoning is weak, and Vodafone urges Ofcom to re-consider the position. We consider this issue on several grounds.

Duplication of expenditure

Ofcom states:

> *"Introducing passive remedies would also potentially add costs of competition. While passive remedies would avoid or reduce the need for BT's competitors to invest in building physical infrastructure, those competitors choosing a passive remedy would nevertheless incur additional costs in network infrastructure. The investments would include the costs of purchasing, installing and managing active equipment and, in the case of PIA, the costs of purchasing, installing and managing fibre in BT's ducts. The investments would, to some extent, duplicate BT's, and would therefore add to the cumulative costs of the industry. Models developed as part of our review of the WLA market suggest that these additional costs could be significant. In the case of NGA investment using PIA, the cost per end-user with four competing networks was modelled at more than double that with just one network."*[10]

This might be so if the costs to the end user are in fact the underlying costs of the equipment – but where the costs to the end user are BT's scaled wholesale costs, then the argument is entirely vitiated. Vodafone and other potential users of PIA have requested the provision of aPIA remedy, confident that the actual costs of provision of high capacity but scalable bandwidth are far below those charged by BT. We have stated that PIA would enable us to invest in further network roll out ensuring wider and richer data coverage for UK consumers. Given this evidence it is not clear that Ofcom can so easily claim that such investment would not be efficient.

Similarly, Ofcom appears to put the onus of proof upon respondents, stating: *"We remain open to any evidence that shows that NGA investment could be unlocked by being able to use PIA for leased lines services, which could help us to formulate our policy in this area."*[11] In Vodafone's view, the appropriate approach is for Ofcom to create the conditions for investment by putting in place the appropriate regulatory environment. Only then, and after a suitable period, can it judge the impact of unlocking of NGA investment. Vodafone is convinced from its experience in ✂ that

[9] Ibid
[10] BCMR 8.60
[11] BCMR 8.89

a favourable impact is very likely, particularly given the known need for high capacity mobile backhaul. Ofcom is too quick to dismiss the possibility of benefits to the national economy from the additional investment.

Moreover, this argument can only be properly assessed if one also considers the beneficial impact on competition and services. The principle of additional cost of duplicative investment can be asserted in relation to any non-monopoly, for example in the case of the mobile industry, but that is only half of the story, given the potential benefit at the wholesale and retail levels of competitive investment. Ofcom does not appear to make any effort to consider the consumer benefits that could be unlocked by PIA.

Economies of scale and scope

Again, Ofcom presumes the outcome and then relies upon that supposition to decide it does not need to encourage competition in this area. It states:

> *"Introducing passive remedies would also carry significant risks. Investment in fibre-based networks is subject to strong economies of scale, and, while passive remedies could reduce barriers to competition based on infrastructure, any such additional competition they stimulate may not be sustainable outside some dense geographic clusters of businesses, such as major urban centres."*[12]

Ofcom virtually guarantees this outcome by restricting PIA to fixed NGA access thereby preventing all operators other than BT from achieving the natural economies of scope and scale available. This point was recognised by the House of Lords:

> "*Lifting the restrictions on PIA could help provide other infrastructure providers withthat breadth [of different revenue streams] and thereby, in our view, play a significant role in introducing more competition at the level of the access network*."[13]

This concern is particularly important as it undermines the ability of the newly combined Vodafone / C&WW business from potentially acting as a greater constraint upon the SMP operator BT.

Recovery of common costs

Ofcom states in this connection:

> *"Furthermore, introducing passive remedies in business connectivity markets could have wider implications on the recovery of common costs that underpins the current pricing of all of BT's regulated products. Extending the example above, BT may respond to competitive entry based on passive*

[12] BCMR 8.61
[13] House of Lords Broadband Report

remedies by reducing its charges for higher bandwidth services. This may, in turn, require rebalancing of the recovery of BT's common costs, which may lead eventually to an increase in its charges for other regulated services, not only for those used in business connectivity markets but potentially also for others, such as local loop unbundling and wholesale line rental."[14]

One possible factor in MNOs' concerns is that BT currently recovers proportionately more of its common costs from its higher-bandwidth regulated products, which tend to be purchased by large organisations, by MNOs and by operators of fixed broadband services, including BT itself. In allowing BT to determine, within appropriate constraints, how to allocate its common costs between the regulated services subject to a charge control, we have previously considered that BT has access to better information than we have to do so, and incentives to achieve outcomes consistent with economic efficiency.[15]

This is a curious argument as Ofcom is perfectly content in other contexts to prevent the recovery of <u>any</u> common costs from particular regulated services (e.g. Mobile Termination Rates). In this case, it uses the threat to BT's recovery of a "disproportionate" amount of its common costs from other regulated services as a reason not to intervene.

It is equally likely that BT's disproportionate recovery of common costs from high bandwidth services is not a sign of economic efficiency, but rather a manifestation of its market power. Faced with increasing customer demand for data and a need to have higher bandwidth transmission further out in their networks, mobile operators in particular have few other choices but to contract with BT, given their inability to use PIA.

Furthermore Ofcom has failed to address the issue of pricing for routes where the traffic demand is greater than 1Gbit/s – it is here that the contrast in pricing between two or more 1Gbit/s Ethernet links and a single PIA link is most acute, and where the loading of operating costs (and to a lesser extent capital costs) purely by scale is most obviously incorrect.

Alternatives to BT Ethernet and PIA for high bandwidth mobile sites

There are no obvious alternatives open to the mobile operators for backhaul supply to high capacity mobile sites other than BT Ethernet and PIA.There are limited alternative suppliers of fibre other than BT, particularly for the last mile, and outside a few urban areas.

It is feasible today for microwave technology to reach up to 400Mbit/s throughput. A significant problem however is the lack of spectrum availability in some frequency bands below 20 GHz. Microwave links that can provide more than 400 Mbit/s of

[14] BCMR 8.63
[15] BCMR 8.82

transmission capacity haveappeared recently in the market. They are placed in the upper part of potential microwave spectrum bands (> 60 GHz): a clear example is the E Band (at 80 GHz). ✂ However the biggest limitation of this band is the maximum hop length, which is less than 3 kilometres.

Higher capacity microwave is thus no panacea: it will have its place in a mobile operator's backhaul portfolio, ✂ but for longer or higher capacity routes it will be an ineffective and impractical substitute for fibre. This considerably reduces its overall attractiveness in comparison with fibre.

Technical development of MEAS

Ofcom states:

> *"We note that MNOs' broader concern that their future backhaul costs could escalate unduly may be addressed to some extent over the next few years by a combination of technical development, which should enable the effective bandwidth delivered by BT's MEAS product through Openreach's 1Gbit/s Ethernet access tails to increase substantially, and by the operation of any charge controls agreed in relation to leased lines following conclusion of this review."*[16]

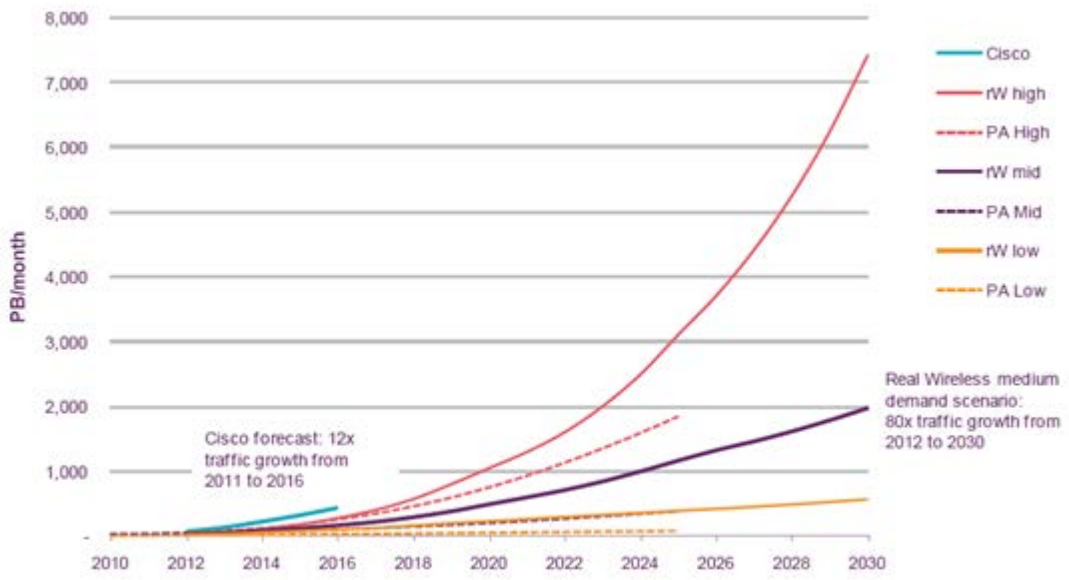
As welcome as this development is, it does not address the fundamental concern regarding the cost/bandwidth structure of BT's prices and the fact that BT's customers are less able to innovate as a result of being dependent upon BT. Complete end to end control of the backhaul network increases the flexibility and autonomy of operations. For the mobile network operator it means better network performance, faster network deployment, the absence of dependencies with third parties, flat growth costs etc. because the network and the topology is aligned with its fundamental purpose, i.e.to efficiently link mobile cell sites with the rest of the network and to support mobile services in the circumstances of sustained high traffic growth.

The requirement for higher capacity PIA

Mobile traffic growth will not be an immediate step change across all cell sites. Figure 2 above suggests the gradual evolution (aligned with underlying technology) of cell site traffic loads in the medium term. Similarly, the Ofcom 700MHz consultation suggests a relatively smooth growth in traffic volume over time. Figure 4 from that consultation is shown below.

[16] BCMR 8.84

Figure 4 – Projected growth in UK mobile data demands



Source: Real Wireless for Ofcom 2012

We appreciate that the current charge control is contemplated to expire in 2015/16, and that by that point the demand for PIA links for mobile operators' backhaul will still be relatively small but growing, and confined to particular routes. It is quite clear however that there is a widespread consensus that the need for high capacity backhaul links will rise significantly thereafter, in order to support the increasing demand for mobile broadband across the UK.

We also appreciate that acquiring the ability to deploy PIA links will take some time.There are various technical and practical issues that will need to be resolved before PIA deployment can be commenced at all, let alone at the significant volumes that will become necessary. This means that the volume of PIA links that could be installed inside the period of the currently proposed charge control could berelatively small and thus areunlikely to significantly impact the recovery of BT's incremental and fixed and common costsacross the forecast volume of all links envisaged in the current charge control model.

But Vodafone believes that there is a strong analogy to the position with respect to the release of 700MHz (or other spectrum) for mobile broadband provision – Ofcom has concluded there that in order to be able to release the spectrum when it is needed, it needs to start planning for this now. Whilst the lead times on preparing for and enabling volume PIA deployment are rather less than those of spectrum clearance, the position is similar. In order for PIA to be available as a deployable solution to the mobile operators when it is needed in significant quantities, Ofcom needs to reconsider the position it has taken in the current consultation: permission needs to be given now.

Vodafone Limited 30th August 2012