Future of TV Distribution

BT Group's response to Ofcom's Call for Evidence

December 2023

BT Group

Executive summary

Today, audience viewing of video content is already shifting online, with more than half of households consuming Video on Demand services and broadcast TV viewing declining across all demographics. A trickle of traditionally broadcast TV channels is already moving online, but over the next decade, we'll start to see a seismic shift away from traditional broadcast as growing consumer appetite catalyses TV distribution towards a modern service, delivered online.

There is no doubt that the move to TV delivery over the internet represents a huge opportunity for the UK. Not only does IP delivery offer significant benefits over DTT and broadcast - higher definition, flexible viewing, personalised viewing recommendations, greater accessibility options and personalised advertising to name a few – but, by virtue of more households becoming more comfortable with the medium, will remove a key barrier to the wider adoption of a range of other digitalised services, such as connected health services, online access to benefits, connected home security services, IP-based radio and online banking. At the same time, DTT spectrum, once freed up, could be instrumental in meeting the increasing demand of a plethora of IoT services in rural and deep indoor areas. This shift online brings TV into the wider competitive and dynamic internet ecosystem, bringing a multitude of services with unique quality of service requirements (shared gaming, connected cities) into one value chain.

In the future, there will be a far greater frequency and scale of 'live' events online. From royal weddings to the pinnacle of international sport, live events are a huge driver of viewers and a massive contributor to the data demand peaks we see on our network. Furthermore, more households are consuming such content in higher definition. UHD coverage – used for a growing range of live events - is only available over an IP or satellite connection. The expectations of the consumer are therefore growing substantially.

We cannot pretend that simply piling ever more content onto finite digital networks, like our core fixed network, won't have an impact. **We expect peak traffic on our core fixed network to grow significantly, by around five times by 2030**, from c. 30 Tbps today to between c. 100 and c. 159 Tbps by 2030. **To dimension our network to cope with this will take significant investment**, just to maintain the status quo of performance. That will have inevitable ramifications, either in pricing, customer experience or network resilience, if we allow headroom to reduce. Thankfully, a significant proportion of this cost can be avoided if those sending the content can be encouraged to adopt more efficient methods of delivery. For example, BT Group's MAUD (multicast-assisted unicast delivery) proposition is up to 10 times more efficient in delivering live content than unicast and makes the adoption of emerging multicast technology even easier for content providers, while also driving down energy usage. At present, misaligned incentives across a complex value chain create barriers to adoption of efficient technologies and investment in network capacity: for example, (i) content providers have insufficient incentives to support efficient distribution themselves as the benefits are shared across the value chain and (ii) content delivery networks currently charge their customers on a per-GB basis so they have limited immediate incentives to reduce traffic volumes. **To guarantee a reliable and resilient TV service in this complex environment will require policymaker intervention to encourage industry coordination of not only TV delivery, but all content delivery.**

We must also address a second impact of the move to IP delivery. Industry and Government are investing in full fibre networks to increase capacity, but we estimate that a small group of households will still not take up a suitable broadband connection in 2030, putting them at risk of being left behind in this digital transition. There is a choice for policymakers here. They could accept some customers will continue to access linear TV over legacy technologies. Or, as we believe, they could support customers to move online. **Policymakers should consider funding of broadband connections, standard equipment, digital skills education, awareness campaigns and reform of social tariffs for those at risk of being digitally excluded**. Done correctly, such policy will secure good outcomes for consumers and the wider UK economy, ensuring a variety of content and greater choice of products, and unlocking access to digital services in other industries such as healthcare and banking, whilst ensuring TV continues to be affordable and accessible.

To support the outcomes of adoption of efficient technologies, investment in network capacity, and broadband adoption, **the regulatory and policy environment needs to evolve and needs to do so now**. Our recommendations to Ofcom and Government are as follows:

- Set expectations for adopting efficient technologies and stimulating network investment for IPTV delivery, including promoting the use of emerging multicast solutions for live concurrent TV. This could include using a combination of (i) policymakers' convening powers and (ii) policy mechanisms to create incentives to deliver live TV traffic efficiently and address imbalances in bargaining power to unlock a two-sided market.
- Consider legislating to require non time critical traffic that is high volume (such as gaming downloads) to time shift away from time critical peaks.

- Carry out a full analysis of the likely timing of a "tipping point" where the costs of running a DTT channel outweigh the benefits to the broadcaster, considering the consumer benefits of any available spectrum being made available for mobile use. This would help ensure that any costs or inefficiencies are kept to a minimum whilst realising the full benefits for consumers.
- Track the speed of the transition to IPTV delivery so that policymakers are well prepared to identify such a "tipping point". For example, broadband take-up, alongside viewing habits, could be a leading indicator for when it could be appropriate for Government to fund broadband adoption to help close the digital divide.
- Outline a cross-industry vision of digital inclusion, which considers funding of broadband connections, standard equipment, digital skills education, awareness campaigns and reform of social tariffs for those at risk of being digitally excluded.

In the following sections, we address each of the questions in Ofcom's Call for Evidence in turn.

Question 1: How are audience demands and expectations evolving, and how does that vary for users of different TV platforms and different demographics?

Consumers are already moving to TV delivered over IP (IPTV) and have growing demands and expectations, creating greater strain on our networks.

- **Subscription Video on Demand (SVOD) consumption is increasing:** Ofcom's Communications Market Report 2023 shows a rise in SVOD consumption from 47% of households in 2019 to 66% in 2023.[1]
- **An increasing number of homes won't use an aerial:** 15% of homes do not plug their TVs into an aerial — preferring to use broadband to watch via apps such as Netflix and iPlayer — but this number is forecast to grow to 50% by the end of the decade.[2]
- **The amount of time spent streaming is set to rise:** Enders Analysis estimate that streaming services are projected to increase their minutes per person per day by 61% and broadcast is set to fall by 21% between 2023 and 2028.[3]
- **The majority of the UK has a smart TV:** The percentage of people who own a smart TV in the UK has risen from 48% in 2019 to 74% in 2023, according to those surveyed in Ofcom's 2023 Technology Tracker.[4,5]
- **Both young and old are leaving broadcast behind:** Over-64s watched 8% less broadcast TV in 2022 than in 2021 and 4-34 year-olds watched 21% less broadcast TV in 2022 than in 2021.[6]

As highlighted in the Government's Broadcasting White Paper, we believe Ofcom should continue to track changes to digital terrestrial television (DTT) viewing.[7] Monitoring statistics which track the speed of transition to IPTV would be helpful to help the industry prepare for an IPTV future. This should include, monitoring broadband take-up alongside existing metrics around viewing habits and Broadcast TV viewing (and DTT-only viewing in particular).

Beyond TV distribution, content is moving to emerging technologies (like virtual reality) which creates increased traffic with different patterns and characteristics.

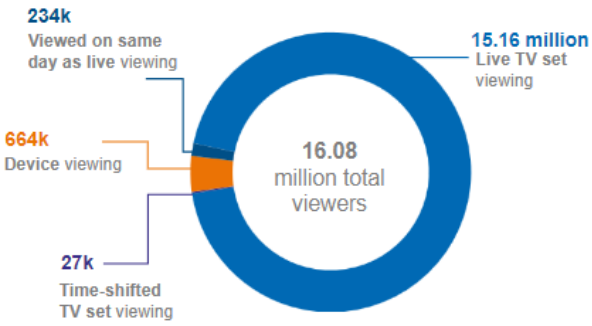
Emerging technologies such as virtual reality (VR), augmented reality (AR) and the metaverse could form new ways of consuming content. Ofcom's 2023 Technology Tracker highlights, for instance, that 6% of surveyed households have VR headsets. [8,9] There are already products on the market which allow consumers to watch TV in VR. As with all future trends, the popularity of these technologies is uncertain, but as more VR products come onto the market, this could create the potential for very large bandwidth demands on our network. These technologies will also require lower latency and higher bandwidths, creating a need to move traffic closer to the edge.

Sports content is time-sensitive and has high levels of live viewing, creating peaks in our network traffic.

During, the England vs France Football World Cup match in 2022, 94% of the total viewing was live (see Figure 1).[10] Sports content attracts high viewing numbers which generates peaks in BT's network traffic. More content, including sports content, is moving to IP-based platforms. Online viewing of the 2022 World Cup on the BBC increased by 57% compared to the 2018 World Cup in Russia. [11]

[1] Ofcom (2023), Communications Market Report 2023.
[2] FT (2023), UK broadcasters develop free digital TV service to take on streaming.
[3] Enders(2023), Broadcasters under half of viewing by 2028.
[4] Ofcom (2023), Communications Market Report 2023
[5] Ofcom (2023) Technology Tracker
[6] Ofcom (2023) Media Nations
[7] DCMS (2022), Broadcasting White Paper, Up next – the government's vision for the broadcasting sector – GOV.UK (www.gov.uk).
[8] Ofcom (2023), Technology Tracker, Technology Tracker 2023 Data Tables (ofcom.org.uk).
[9] The Ofcom Technology Tracker is a survey with a sample size of about 4,000 adults aged 16+ in the UK, Annex 1 – Methodologies and Glossary (ofcom.org.uk).
[10] Thinkbox (2022), TV viewing report.
[11] BBC analysis

Figure 1 Sports content is time-sensitive, so has high levels of concurrent viewing



Source: Barb 2022. Individuals, Live +3min. World Cup QF: England v France, ITV, 10 December 2022. Device and time-shifted viewing within 28 days of broadcast

When popular live viewing coincides with other uncoordinated traffic (e.g. large games downloads) we see a 'super peak' of very high traffic volumes. For example a super peak occurred on 6 December 2023, on BT's network caused by a Fortnite game download, a Call of Duty game update and six Premier League matches ([✂]). This generated a peak of 30.1 Tbps. Managing the timing of gaming downloads would help prevent the occurrence of super peaks in network traffic. Policymakers could convene gaming companies and ISPs to discuss solutions to this challenge. Our response to question 6 expands on this.

[✂]

A clear shift has already begun and by the end of the decade most TV will be viewed online across a range of devices. As explained in the next section, traffic needs to be managed in an efficient way to meet consumers growing appetite for content.

Question 2: What do audience trends mean for the financial prospects and sustainability of TV distribution platforms, and what are the key decision points over the next ten years?

As a result of the trends described in our response to question 1, we expect a significant increase in internet traffic over the coming years and for the pattern and characteristics of that traffic to change as new services become available and popular such as VR, connected health services and immersive learning. As shown below in [✂], we expect peak traffic on our core fixed network to grow from 34 Tbps to between 100 and 159 Tbps by 2030 [12] (unless industry adopts measures to make traffic delivery more efficient). The vast majority of this traffic will be for live TV, particularly 'super peaks' caused by live special events such as major sports tournaments and coronations for example. Our projected total[13] core network capex requirement to meet total peak demand by 2030, assuming we scale our fixed broadband network accordingly, is [✂] [14] (compared to a historical core network capex [✂]), of which the IPTV cost alone (accounting for non-IPTV traffic peaks) is [✂].[15]

[✂]

These costs form part of the overall costs we could face to support all types of broadband traffic by 2030, which we shared with Ofcom in our response to question 15 of Ofcom's April 2023 net neutrality Statutory Information Request (SIR). By comparing this SIR response to our fixed network capex budget forecast, in question 10 of our response to Ofcom's February 2023 net neutrality SIR, Ofcom will see that [✂].[16] We will therefore either need to find some way of covering all of these costs, for example by passing them on to consumers, or accept a lower level of network quality in times of congestion to protect network resilience.

To avoid these costs being passed on to consumers or reducing our network quality or resilience, it is crucial that:

i) The most efficient means of IPTV distribution for the content type and volume is chosen. This includes emerging multicast technologies.[17] We consider that deploying emerging multicast technologies, depending on deployment timing and adoption within the BT customer base, could save a significant part of the costs above. For example, in the [✂], emerging multicast technologies could save [✂]. We also believe emerging multicast technologies deliver greater quality of service especially reliability, benefitting content producers and viewers.

ii) Non time critical traffic that is high volume (such as gaming downloads) are required to time shift away from time critical peaks. It may be that networks also innovate to provide options to deliver this content efficiently which enables freedom from this timetable – content producers generating large file volumes would then have the choice of time shifting over the open internet or working with network providers on these options.

iii) Network providers have more regulatory freedom to deal with less collaborative actors. The current open nature of the internet relies on a 'good chap' theory of content producers choosing distribution options which support other end users and networks' best interests. This is not always the case and one content producer refusing to work collaboratively can impact any other end user's experience of receiving entirely unrelated content. While we expect specialised services with guaranteed QoS to provide part of the answer here for large UK focused content producers, some video content will continue to travel via the open internet. Regulatory change is needed to ensure that network providers can traffic manage content producers that are not behaving responsibly to protect all end users experience.

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[12] The forecast covers fixed broadband residential customers specifically looking at the evolution of web browsing (other), daily live TV viewing (e.g. news, drama, etc), special event live TV viewing (i.e. those events that are around a few times per year at best), software download (e.g. games, OS updates, etc) and VoD viewing (SVOD, AVOD, etc)

[13] Including what's in our current business plan

[14] [✂]

[15] [✂]

[16] [✂]

[17] Specifically, Multicast Adaptive Bitrate (mABR) solutions. Recent international implementations of these are referenced in:

- Advanced Television (2022), "Broadpeak mABR solution optimises live sports OTT delivery in Italy"
- 202 Communications (2021), "Megacable Improves TV QoE With Broadpeak's CDN and Multicast ABR Solutions"
- Broadpeak (2023), "Orange streams with mABR to guarantee quality in live events"

The Government should consider these points and make the necessary changes to legislation in the next few years, to ensure these distribution principles are supported in the UK law and regulation, especially if they want to maintain the UK's long standing 'universal' reach of UK TV.

[✂]

Some advertising supported content producers have expressed doubts about multicast as, for them, being able to deliver personalised advertising is a key part of the business model. New innovations mean emerging multicast technologies could support personalisation through techniques like Dynamic Ad Insertion (DAI), in which the main stream is encapsulated in multicast but there is the potential to 'stitch in' ad content locally. Ads are delivered in parallel with main content (lower bitrate as slower delivery) and in advance of the ad break; and are then played out from local storage during break. Since the ads are pre-loaded, they are always high quality. BT TV already pre-loads ads in a similar way.

Emerging multicast technologies could be available to all ISPs, even those who don't wish to deploy multicast in their own core networks, making universal adoption of multicast (mABR) possible, as illustrated in [✂]:

[✂]

Emerging multicast technologies also improve energy efficiency and therefore support ESG objectives.[18] We estimate that adopting emerging multicast technologies for live TV distribution will reduce BT's energy consumption [✂], based on [✂] and assuming multicast applies to [✂] of all live TV.[19] This is enough to power 6.5 – 7.8k average households per year by 2030. The carbon footprint impact is 6.8 – 8.2 tMg CO_2 per year by 2030.[20]

While we do not have data on the carbon footprint of other distribution technologies, it is self-evident that it is energy inefficient to run multiple distribution networks where one approach (e.g. IP delivery) can be substituted for another (e.g. broadcast delivery) especially once the majority of viewers and viewed minutes prefer one service over another, as we expect with IP distribution vs, broadcast at some point in the 2030s. The energy efficiency gains of consolidating distribution to less or just one technology (since the same points should be considered vs. how long satellite distribution continues) should be factored into the business case for providing public subsidy to support households to transition to IP distribution.

However, even with the adoption of emerging multicast technologies, [✂],[21] which could still mean higher prices and/or a lower level of network quality in times of congestion to protect network resilience. To avoid this, we believe policymakers should unlock a two-sided market, through a combination of net neutrality reform and policy mechanisms to address imbalances in bargaining power, as we explain further in answer to question 6.

On the sustainability of other TV platforms, we cannot comment on when DTT or DSAT could become unviable as we do not have data on this. However, we note that Ofcom's Call for Evidence states, *"some broadcasters have indicated to [Ofcom] that there can be a tipping point where the costs of running a DTT channel outweigh the benefits to the broadcaster"*. Ofcom is well placed to request comparable industry data, including financial data from broadcasters, in order to be better informed to make some of the key decisions they will need to make over the next 10 years. These decisions include:

- Should Ofcom and/or Government promote the use of efficient distribution methods (such as emerging multicast technologies) by all participants in the value chain, given the efficiency savings and environmental benefits, using a combination of (i) policymakers' convening powers, (ii) net neutrality reform (iii) policy mechanisms to address imbalances in bargaining power to unlock a two-sided market? We recommend policymakers make a decision on this as soon as possible to provide certainty, given the other activities in [✂].
- Should multiplex licences be extended beyond 2034? Again, we recommend policymakers make a decision on this as soon as possible to provide certainty, given the other activities in the timeline below.
- If some multiplex licences will not be renewed, then should this available spectrum be freed up for mobile use, given the consumer benefits of this which we summarise in our answer to question 5? We recommend policymakers make a decision on this as soon as possible after a decision on renewing multiplexes has been made, to provide certainty.

[18] Networks and Applied Research (2020) Energy consumption in the UK 2020, KWH-to- CO2 (rensmart.com).
[19] Assumes 3.7MWh per household per year and between [✂] and [✂] of Live TV over efficient solutions
[20] 0.281 kg CO_2/kWh
[21] Based on multicast creating [✂] of savings, as per [✂]

[✂]

Lastly, some stakeholders may make the case that DTT should be extended beyond 2034 and should be subsidised if necessary to make this viable. When considering the options here, the cost and value for money of any subsidy should consider the cost of this compared to the cost and wider public policy benefits of instead subsidising households without a broadband / IP connection to get one, the necessary device upgrades and skills support to use it. This is a public policy agenda of its own, with considerations far beyond the future of TV distribution. It may be that public policy programmes focused on improving digital inclusion reduce the number of households without suitable connectivity faster than we have projected (our modelling assumed no further interventions to support the adoption of broadband). We explore this further in our answer to question 6.

Question 3: How do broadband networks and supporting infrastructure need to evolve to support resilient delivery of TV over the internet in the future?

See our answer to question 2 above.

In addition, we note that our mobile network wouldn't be able to support the vast majority of viewers' usage, except perhaps in special edge cases (for example, in very rural areas where Project Gigabit won't reach but mobile coverage is available).

Furthermore, simultaneous live viewing is already causing significant peaks in our network ([✂]). Peaks will become larger and more frequent over time; we could see peak demand for TV alone at [✂]. We need to manage network traffic to allow enough capacity in the network for resilience, even when there are special events. We also need to manage our costs and energy use to be as efficient as possible, to keep customer costs affordable and minimise energy usage. As most viewers watch entirely online, we expect the peaks to get higher – the below peaks are Premier League football. We expect a peak for an England game in the World Cup or a significant event like a royal wedding or funeral to be considerably higher in future.

As per our answer to question 2, this implies we need adoption of emerging multicast technologies to manage live traffic of notable popularity. This is necessary for cost and energy efficiency and to support reliability. We have now announced the development of BT's new multicast technology on our website.[22]

We also need policymakers to address and manage 'super peaks' - where a popular live event and a large download release (e.g. a gaming update) clash. As the graph below shows (see [✂], these currently drive the largest peaks. And as the live event peaks get larger and games and other updates also get bigger, we expect the largest super peaks to be very large indeed (could exceed 10x current peaks by 2030 without a more efficient solution). While some of this can be addressed by emerging multicast technologies, we also believe new requirements should be brought in for large but non time critical content, such as gaming downloads, requiring its distribution to be time shifted away from key UK dates and perhaps also busy times of day.

In addition, content and application providers should invest further in virtual CDNs / deeper caches to bring their content closer to the viewer, significantly reducing load on upper links.

Lastly, policymakers need to enable networks to better address less collaborative actors, as explained in question 2.

[✂]

With the requirements outlined in question 2 fulfilled [✂], our broadband network will continue to be resilient. Today our core network, which is responsible for routing data across vast distances and can be regularly expanded (to carry more data) through capacity upgrades, delivers better than [✂] availability to exchange level: this is better than [✂] outage per year. Our core and backhaul networks have multiple [✂]. Our access network, which provides the final link to individual users and evolves with step-changes in access technology, is becoming more reliable with our rollout of Fibre to the Premises (FTTP); at least 99% of premises will have FTTP access by 2030 under the Government's Project Gigabit (implying major changes wouldn't be needed to the Broadband Universal Service Obligation to make IPTV a reality). And, in the event of an access network fault affecting a single or small number of premises, our mobile network could potentially provide a back-up connection. Although more local equipment such as broadband routers are more exposed to, say, a local power cut, in practice a local power cut would make viewers' TV sets unusable in any case.

[22] BT (2023) BT Group announces live TV technology breakthrough to meet growing customer demand

Question 4: In what ways might different types of 'hybrid' terrestrial and internet services deliver benefits for audiences and what risks may arise?

As TV moves from traditional broadcast to a hybrid environment, wider consumer benefits will be unlocked.

IPTV will deliver a wide range of consumer benefits. In contrast to DTT, IPTV will offer: higher definition, flexible viewing, personalised viewing recommendations, greater accessibility options (such as signed content on any channel), personalised advertising and access to a wider range of content. Today, over 97% premises in the UK have access to broadband capable of at least three high definition (HD) live TV streams, or at least one ultra-high definition (UHD) live TV stream.[23,24] Looking ahead, Gigabit-capable broadband will be sufficient for UHD streaming and beyond to 8K.[25]

We agree with Ofcom that the increasing consumption of content over the internet creates a risk of a fragmented user experience and that some audiences will want to continue to consume TV content in a similar way. We understand that 'hybrid' technologies (such as Freely) are in development which will maintain a familiar user experience whilst also enabling the additional consumer benefits noted above. Industry will need to work together to ensure these future solutions consider efficient delivery of content over the internet and as set out in more detail in our answer to question 2, the Government is likely to need to legislate to ensure this is the case in all scenarios.

IPTV also has the potential to unlock access to other digital public services and create a truly digitally inclusive UK. Some customers may be encouraged to get an internet connection to access the benefits of IPTV, subsequently reducing the barrier to engagement with other digital services including health, social care and accessing Government services online. In addition, Televisions are no longer solely used for entertainment purposes. TVs are already available on the market which allow you to access telehealth services and video call your friends and family — providing wider social benefits.

A managed transition is needed to help stop vulnerable cohorts from being left behind in the transition to IPTV.

As consumers transition from legacy technology, there is a risk that some cohorts are left behind and fail to realise the benefits of IPTV. Already, some customers are not able to access high quality programming in UHD as this is not available via DTT. It is likely that those left behind are from lower socio-economic groups who may, for example, not be able to afford upgrading old hardware to IPTV-supported devices. It is likely to be consumers who only have a DTT connection that are at most risk. While online TV content is readily available, the speed of transition to IPTV will depend on how quickly consumers upgrade to hardware that supports IPTV. Moving to TV delivered over the internet also requires digital skills — which older cohorts in particular may require assistance with.[26] The Media Bill will, to an extent, facilitate this technology transition by ensuring prominence of Public Service Broadcaster (PSB) content and ensuring video-on-demand content is accessible.[27] We understand Freely should also help facilitate the transition by replicating the terrestrial TV experience, offering a familiar user experience.[28] Given the transition from analogue to digital broadcasting took approximately 10 years, the time to start managing this transition is now.[29,30] See question 6 for the coordination and planning which is likely to be needed to manage this transition.

Operating a hybrid environment could introduce a market inefficiency.

As customers transition to IPTV, there will be fewer DTT viewers. We assume this will increase the cost per view, eventually making DTT economically unviable, but we don't have the data to support this assumption and we would recommend Ofcom collates data from broadcasters/transmission providers to carry out a full assessment. Before reaching this tipping point there will be two sets of costs to deliver TV: one for IPTV and the other for DTT. We note this is economically inefficient and bears the risk that the cost of duplicated distribution systems will be borne by customers. It would therefore be reasonable to assume any transitional period should be kept to a minimum.

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[23] Ofcom (2022), Connected Nations 2022 UK report.
[24] Based on BT Group internal data [✂]
[25] Medium (2021), Intel Goes for Gold by Processing and Streaming more than 4.7 PetaBytes of Live 8K, 60 fps, 10 bit HDR Sports Content from Tokyo 2020 Olympics | by Intel | Intel Tech | Medium.
[26] BT Group (2023), Digital Inclusion.
[27] House of Commons Library (2023), Media Bill: policy background
[28] Everyone TV (2023), New service from UK public service broadcasters will deliver live free TV via IP,
[29] Pumfrey, Alex (2017), The UK's switch to digital TV.
[30] National Audit Office (2008), Preparations for Digital Switchover - National Audit Office (NAO) report

Question 5: Given the sharing of infrastructure, what would the implications for other sectors be if there was a change to the use of DTT?

A small proportion of our sites could currently be used for DTT, as well as mobile. However, if there was a change to the use of DTT, we do **not** expect that this would significantly affect the financial feasibility of continuing to use these sites for mobile.

We cannot say if the same is true for radio, as we do not have sufficient data on the economics of radio.

However, we note that, if DTT was switched off or condensed into a more basic service, then reassigning any available spectrum[31] to mobile could increase the value of some DTT sites to mobile network operators, as they could use these sites with 600 MHz spectrum as well as other mobile spectrum bands. We think Ofcom is well-placed to carry out a full cost benefit analysis of different options for spectrum allocation.

If DTT was switched off or condensed into a more basic service, then reassigning any available spectrum to mobile would also confer several benefits to consumers:

- Ofcom has noted the interest in gaining access to 600 MHz for rural coverage and deep inside buildings where greater capacity of such coverage will be required in future.[32] We very much support this requirement.
- Incremental sub-1GHz frequencies will play a critical role in providing additional capacity in the more difficult to reach places and will enhance the network quality experienced by consumers and IoT devices. This results from the favourable propagation characteristics of these bands and the possibility to efficiently use the frequencies with existing site infrastructure. The availability of additional sub-1GHz frequencies will result in increased connection speeds experienced by uses in places where coverage is only possible with lower frequencies, such is in buildings served by outdoor base stations and towards the edge of coverage of rural cells.
- The availability of additional sub-1GHz spectrum could be important for improving the quality coverage of roads and rail and closing the digital divide by enabling improved network performance in more rural areas.
- Although we expect the main benefit of additional spectrum would be improvements to network quality as a result of deploying the spectrum on existing sites, the availability of additional sub-1GHz spectrum can reduce the cost of delivering a given amount of capacity as fewer sites would be needed to cover an area. A contribution by GSMA to an EC workshop[33] on the future of the UHF band for TV referenced a GSMA study where it was simulated that an extra 2 x 10 MHz of sub-1GHz spectrum in an operator network requiring 20 Mbit/s edge of cell coverage could reduce the required number of sites by 21%. This illustrates that it could be more feasible to cover new areas if more sub-1GHz spectrum is made available as the business case to provide service would be improved.

The outcome of the ITU WRC-23 represents an important step to support the future option to migrate existing use of some or all of the 470 -694 MHz band from DTT Broadcasting to mobile use. We are supportive of the UK's decision to be included in the secondary allocation to the mobile service in the band 470-694 MHz by footnote to the Table of Frequency allocations in Article 5 of the ITU Radio Regulations and welcome the prospect to introduce a primary allocation to the mobile service in the 614 – 694 MHz band at the ITU WRC-31. This will ensure that options to use the band for mobile are developed as this should have a positive impact on development of a mobile ecosystem for this band.

[32] Ofcom (2022), Mobile networks and spectrum: Meeting future demand for mobile data.
[33] "Use of the UHF band in Europe - A new look at an old debate", GSMA, April 2022.

Question 6: What coordination and planning across the value chain might be necessary to secure good outcomes for audiences and key providers over the long term?

Coordination and planning will be required across the value chain to:

(i) Ensure incentives are aligned to secure efficient investment in networks and;
(ii) Promote wider digital inclusion policy, ensuring no one is left behind.

Misaligned incentives across a complex value chain create barriers to investment in network capacity for quality IPTV delivery and innovative services.

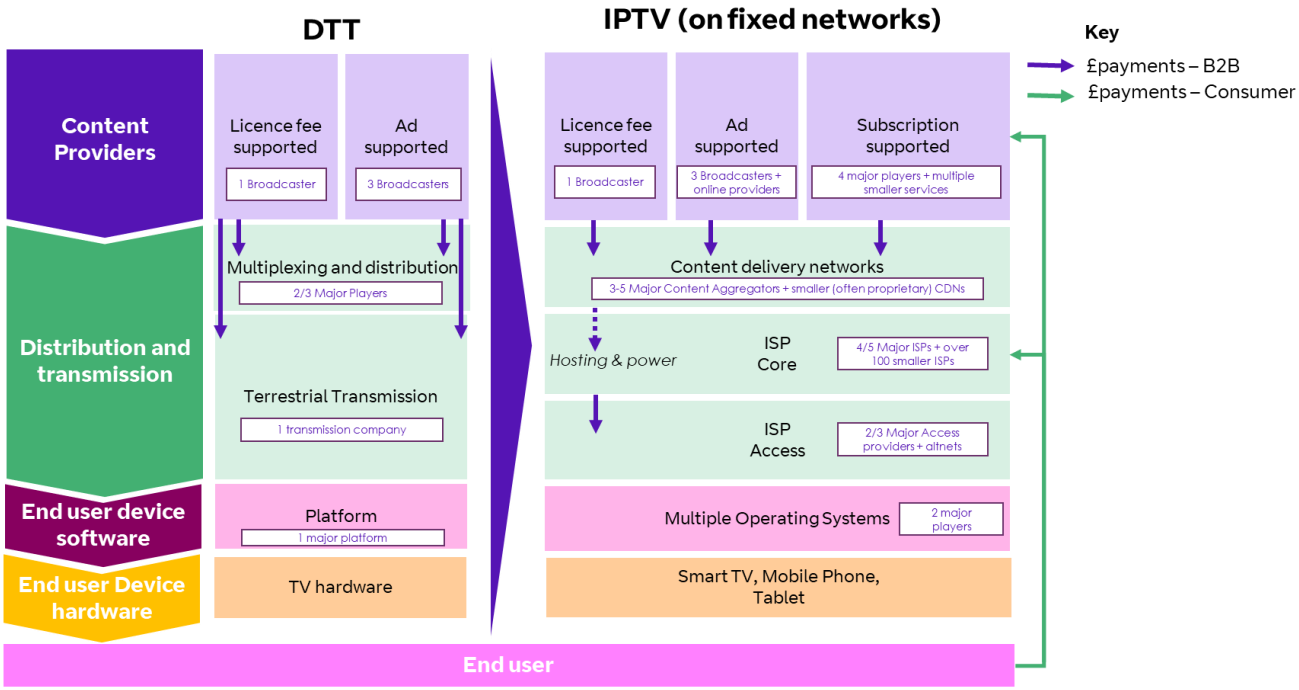
As Ofcom identifies in Figure 2 of its Call for Evidence, the IPTV delivery value chain is more complex than the DTT value chain, with many parties each having their own objectives and commercial incentives. Whereas previous methods of distributing TV have been TV-specific, now players across the TV distribution value chain also need to consider how TV interacts with other industries (e.g. gaming, connected health monitoring) utilising the internet to distribute content. In addition, whereas historically broadcasters have owned and/procured their own distribution channels, in an IPTV world they can currently access ISPs' services for free, and in some cases without engaging with the ISP to plan best arrangements at all. This disintegration of the technology and value chain brings consumer benefits, as it fosters a competitive market and gives space for good actors to innovate. However, it also brings complexity which is hard to coordinate and creates a number of misaligned incentives which drive the need for a combination of policymaker intervention and enhanced market mechanisms to assess and address end to end trade-offs and co-ordination problems.

Firstly, costs in the IPTV delivery value chain are volume-sensitive. Higher traffic volumes drive the need for greater investment in ISPs' core networks. However, content delivery networks (CDNs) are beneficiaries of these high traffic volumes through current established volume-based (per gigabyte) commercial models. Content providers have commercial arrangements with CDNs but do not directly pay for distribution over IP. Content providers also have limited incentive to invest in efficient solutions such as multicast where the benefits of those solutions will be shared across the value chain. For example, a content provider could build a new online TV service incorporating innovative services which customers want (e.g. hyper-personalisation, low latency) but the content provider has no incentive to consider how that service will be distributed efficiently (e.g. including multicast functionality). There is therefore not strong enough alignment across the value chain to sufficiently incentivise efficient distribution over the internet. This results in avoidable costs for ISPs which are ultimately passed to consumers through retail pricing, or risks a lower level of customer experience in times of congestion to protect network resilience.

Secondly, many players are loosely incentivised around quality, but there are misaligned expectations on who is responsible for guaranteeing that quality. Some content and application providers (CAPs) want to provide their customers with a quality video service (for example, providers of high-quality video content viewed on large devices like TVs); others are less sensitive to service quality (for example, some providers of user-generated content viewed exclusively on smartphones). ISPs want to provide quality connectivity to deliver that service. Where quality is valued, CAPs are incentivised to create innovative products for customers, but do not need to pass the benefit of that to network operators who see an increase in traffic. In the current value chain consumers are picking up the cost of IP distribution by paying for the retail broadband service, which means that content providers have limited interest in the underlying service. For ISPs, quality is impacted by capacity: if the network becomes congested, there is a risk to quality of content. However, ISPs have limited levers to manage that congestion, especially when it is driven by individual content providers. [✂]. ISPs face a choice - either find a way to cover all of these costs – which are not currently in our budget — or accept a lower level of network quality in times of congestion to protect network resilience. Policymaker intervention is therefore required to create an environment which stimulates efficient investment in networks.

Finally, disjointed payment flows create different expectations on who contributes to investment. Figure 2 outlines the payment flows along the DTT and IPTV value chains. Payments along the DTT value chain flow in one direction, with CAPs paying for distribution and transmission. In the IPTV value chain payment flows are more disjointed. ISPs bear network capacity and access costs, without contributions from CAPs/CDNs, even though CAPs benefit from access to consumers.

Figure 2 payment flows across simplified value chain in delivering TV content to audiences on DTT vs IP networks



This means that consumers are bearing all the costs of content distribution in a "two-sided market", as retail pricing is the only lever for recovering costs and stimulating the necessary investment. As outlined in our response to question 2, increasing traffic and changing traffic profiles continue to drive the need for additional investment in networks, alongside adoption of emerging multicast technologies. In addition, economically efficient investments that generate value to CAPs or third parties (e.g. advertisers) but only indirectly to broadband/mobile consumers may not go ahead. For example, an application offer by a CAP with a certain service level which is funded by advertising revenue. Net neutrality regulations alongside imbalances in bargaining power between content providers and ISPs creates a zero-price constraint on one side of the market, creating a barrier to the necessary investment networks and/or risking higher retail prices.[34]

[✂]

Policymaker intervention is required to address tensions and ensure efficient investment and good audience outcomes.

We don't believe the market will resolve these tensions without policymaker intervention. Policymakers should address tensions by outlining a vision for the future of content distribution (including linear TV) which requires efficient distribution and promotes investment in networks. This vision should include:

- Setting expectations for adoption of efficient technologies for linear IPTV delivery (including emerging multicast technologies) which policymakers then encourage all industry participants to adopt using softer forms of intervention/convening powers, where no formal powers exist;
- Legislation to require non time critical traffic that is high volume (such as gaming downloads) are time shifted away from time critical peaks (typically coinciding with special live TV events). It may be that networks also innovate to provide options to deliver this content efficiently which enables freedom from this timetable – content producers generating large file volumes would then have the choice of time shifting over the open internet or working with network providers on these options.
- Fundamental reform of net neutrality regulation to enable ISPs to traffic manage individual "less collaborative actors" as an incentive for efficient use of networks. A principles-based approach such as a code of practice would remove barriers to delivering differentiated service requirements (such as a quality protected linear TV stream) and bringing benefits to consumers quickly, and;

[34] We refer to our response to Ofcom's consultation on Net Neutrality guidance for further analysis on two-sided markets.

- A policy mechanism to address imbalances in bargaining power to unlock a two-sided market which would benefit consumers, content providers and ISPs by further incentivising efficiency (putting a price on traffic volumes/capacity), promote efficient investment, drive innovation and deliver better consumer outcomes.

Ofcom's recent net neutrality statement has been helpful to provide flexibility to ISPs in efficient distribution of content, clarifying that live TV via multicast could be a specialised service and recognising the potential benefits of more targeted traffic management. However, greater coordination and legislative change is required to incentivise adoption of efficient technologies and to secure reliable and resilient distribution of TV that audiences are used to. Policymaker intervention is necessary to achieve this.

Transitioning to internet-enabled TV could help drive a more inclusive digital future for the UK.

BT has a vision of a bright, digital, connected future for the UK. As outlined in our answer to question 1, the shift to online viewing is already happening for a large percentage of the UK population, driven by new content, technology, and services. However, as Ofcom recognises, some households would likely not choose to adopt, or be capable of adopting, internet delivered services, without assistance. [✂]. This broadly aligns with Ofcom's finding that 3.7m households only use DTT to receive linear TV services, [✂]. [35] We agree that this cohort of households is likely to be older, and/or less well off. It is also likely to be a mixture of those who cannot afford broadband, don't have the digital skills to use it, or simply do not want it. [36] It is this cohort which should be the focus of digital transition policy and pro-active interventions. Households in a "hybrid" environment already have a broadband connection and are therefore less at risk of being left behind.

In supporting this group, policymakers face a choice: (i) maintain existing distribution technology to enable this cohort to continue to watch linear TV in the way they are used to or (ii) support this cohort to get online via a cross-industry public policy interventions which considers funding of broadband connections, equipment, and digital-skills education and support. The latter creates an opportunity for a truly digitally inclusive UK; research commissioned by BT and conducted by AbilityNet suggests that a specific goal such as "making doctor's appointments, entertainment, applying for jobs or staying connected with family" helps digitally excluded users see the benefit of going online. [37] IPTV could motivate people to go online for the first time; once a customer is online, there are less barriers for engagement in other digital services. Cost of connectivity is one consideration; whilst some ISPs including BT offer 'social tariffs', one million households in the UK cannot afford any connectivity at all.[38] We think wider social policy reform is needed to focus on the very low-income customers for whom cost is the main barrier for getting online. But wider intervention is also required to address issues such as digital skills and confidence. For example, vulnerable groups experiencing digital poverty may be uninterested in engaging with the digital world due to lack of trust, so encouraging digital adoption through trusted sources (e.g. phasing out non-smart TVs) could help tackle digital poverty. [39] This is a systemic issue which is relevant to multiple public policy agendas beyond TV including for example banking, [40] healthcare, [41] social care, [42] rail[43] and UK productivity more widely.

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[35] [✂]

[36] Ofcom (2023), Online Nation Report, p15 – "Among people without internet at home, a perceived lack of need or interest (65%) remained the main reason for not having it. However, a quarter (26%) cited reasons related to cost."

[37] BT Group (2023), digitalinclusionnewinsightsandfindingasustainablewayforward.pdf (bt.com), p32

[38] Frontier Economics (2023), 'Low income households and affording connectivity', published as part of BT Group's publication 'Digital inclusion: New insights and finding a sustainable way forward' on 20 October 2023

[39] Deloitte (2023), Digital Poverty in the UK: A socio-economic assessment of the implications of digital poverty in the UK, p8

[40] Age UK (2023) As bank branches continue to close, a new Age UK report reveals that 4 in 10 over 65s with a bank account do not manage their money online

[41] The Health Foundation (2023) How do the public and NHS staff feel about virtual wards? (health.org.uk) 'respondents in socioeconomic groups D and E who said that they would not want to be treated through a virtual ward were also more likely to say that their home would not be suitable for a virtual ward compared with those in other socioeconomic groups'

[42] LGA (2021), Social Care Digital Innovation Programme | Local Government Association - NHS funded trials of digital innovations in social care found increased satisfaction rates for service users and carers, reduced hospital admission, savings of health and social care staff time and resources, reduced digital exclusion (where the trial supported with this.

[43] Rail Delivery Group (2023), Customer Focused Stations (raildeliverygroup.com). In summer 2023 rail operators consulted to make changes to the majority of rail station ticket offices in England. They note that the volume of tickets sold via offices has dropped from 82% in the mid-90s to 12% today. These numbers are very similar to the proportion of households without broadband, and are likely to have a big overlap. However the proposals received a strong reaction from those that rely in ticket offices as not sufficiently addressing out how those unable to buy tickets online could do so, nor, related, how those needing additional support e.g. to board a train could reliable secure this via an online first approach. These proposals have now been withdrawn.

[44] Therefore, consideration of sources of funding and potential benefit reach far beyond the TV or internet industries.

Cross-industry coordination and planning is required to manage the costs of transition and bridge the digital divide.

There will come a time when most TV is being consumed over IPTV and the economic viability of DTT has declined. We don't have the data to determine exactly when this will happen, and broadcasters will have data to inform a more precise timescale, but our assumption is that it's likely to happen in the next 10 years. We think Ofcom is well placed to collate data from across the industry to determine more specific timeframes, informed by a full cost-benefit analysis.

Considering the above, at the appropriate time, a managed transition to IPTV will be required to support digital inclusion and maintain universal availability of television. Policymakers should consider:

- The funding model for customers at risk of being left behind. We estimate that connecting these households to a basic broadband service would likely cost around [✂].[45] The benefits of connecting these customers would be seen across the value chain as well as in adjacent industries. Policymakers should consider such wider benefits when prioritising and identifying the sources of funding for this group, alongside reform of social tariffs for those at risk of being digitally excluded.
- The standards for what are reasonable kit for customers to own. Once connected to the internet, it is likely that these customers will need additional equipment installed in their home and support for maintenance to watch internet delivered TV services. Policymakers should consider setting standards for manufacturers to remove complexity and address compatibility issues. This could include ensuring equipment is compatible with multicast technology.
- The right mechanism for raising awareness of the transition. The previous analogue to digital switchover ran a nationwide campaign to raise awareness and provide support to vulnerable customers. A similar programme is likely to be required to manage this transition.
- Some viewers are likely to need support and training to ensure they have the digital skills and confidence to use the new technology.

A coordinated approach considering all the above factors and the associated costs will ensure that all audiences continue to have access to universal television for entertainment and information, as well as creating an opportunity to introduce and access additional digital services such as banking, or digital healthcare such as virtual wards.

This kind of programme will require funding; and is an additional funding need alongside the network investment gap that network providers face (which we discuss in response to question 2).

We think it likely that the overall return from the society and economy wide benefits of enabling a near universally digitally connected UK will be substantial and far outweigh the costs of delivering it. An early attempt to estimate these certainly suggests so.[46] The challenge is that these benefits do not neatly line up into a value chain that makes it rational for any one actor or group of actors to fund it. Rather, given the widespread positive externalities, there is a clear case for public policy intervention to ensure these benefits are realised.

The time for addressing these challenges through coordination and planning is now.

Based on the timeframes for previous (less complex) transitions, these challenges need to be addressed now. Analogue to Digital switchover for example took around 10 years from policy to switchover.

There is a risk that complexities in the value chain create a lack of focus on a facilitating a transition to IPTV. Some market players may focus on sustaining DTT revenue sources rather than considering future distribution methods. But audience trends are moving online, so there is a risk that an already digitally excluded group gets left behind. Coordination by a policymaker and/or a standards body is therefore required to ensure a smooth transition.

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[44] Deloitte (2023), Proposal_A4_3col (digitalpovertyalliance.org), p7 "billions of pounds in benefits for individuals, government and businesses could be unlocked each year by eliminating digital poverty and ensuring basic digital needs are met for all individuals. The most significant benefits appear likely to be realised through positive impacts on human capital and productivity."

[45] Based on a commercial BT basic product at £20 a month

[46] One of the key findings from new research by Cebr for Good Things Foundation (July 2022): The Economic Case for Digital Inclusion in the UK. Cebr calculated a positive cost-benefit ratio of £9.48 return for every £1 invested in supporting 508,000 people annually to gain basic digital skills from 2023 to 2032. Building a Digital Nation - Good Things Foundation

Appendix A Confidentiality

We have redacted all information we consider to be confidential throughout the document and Table B.1 for ease of reference. Given the sensitivity of the information contained in this response, BT further considers that disclosure would be prejudicial to BT's business interests, accordingly, the confidential information provided should not be published or disclosed to any third party without BT's prior agreement.

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The information enclosed with this response has been provided on the basis that it will only be used for the purposes of this Notice, i.e. to progress Ofcom's work in relation to the future of TV distribution, and for no other purpose, unless otherwise agreed in writing by BT.

Table B.1. Confidentiality Schedule

Page	Reference	Category	Comment
	[✂]	Exec Summary	Commercially Sensitive
	[✂]	Question 1	Commercially Sensitive
	[✂]	Question 2	Commercially Sensitive
	[✂]	Question 3	Commercially Sensitive
	[✂]	Question 4	Commercially Sensitive
	[✂]	Question 5	Commercially Sensitive
	[✂]	Question 6	Commercially Sensitive

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