Call for Evidence response form

Please complete this form in full and return to
FutureofTVDistributionCallforEvidence@ofcom.org.uk

Title	Call for evidence: Future of TV Distribution
Full name	[redacted]
Contact phone number	[redacted]
Representing (delete as appropriate)	Organisation
Organisation name	MainStreaming
Email address	[redacted]

Confidentiality

We ask for your contact details along with your response so that we can engage with you on this consultation. For further information about how Ofcom handles your personal information and your corresponding rights, see Ofcom's General Privacy Statement.

Your details: We will keep your contact number and email address confidential. Is there anything else you want to keep confidential? Delete as appropriate.	Nothing
Your response: Please indicate how much of your response you want to keep confidential. Delete as appropriate.	None
For confidential responses, can Ofcom publish a reference to the contents of your response?	Yes

Your response

Question	Your response
Q1. How are audience demands and expectations evolving, and how does that vary for users of different TV platforms and different demographics?	Confidential? – No **Introduction to MainStreaming** MainStreaming is an Intelligent Media Delivery Company that empowers broadcasters, OTT providers, and media and entertainment industry to ensure the best Quality of Experience to their audience, providing scalability and full control over the video distribution process. Our solution improves network efficiency, delivers exceptional

reliability, enhances Quality of Service, and provides a tangible financial and environmental ROI.

MainStreaming has purpose-built its innovative end-to-end Edge Video Delivery Network to address ultra-low latency, high-definition video delivery. It is a leading provider of Carbon Neutral Intelligent Media Delivery Platform that integrates optimization capabilities, video streaming workflows, real-time monitoring and analytics, customizable solutions with the intent of delivering a seamless experience to millions of concurrent viewers.

Our perspective provided in this response to Ofcom's Future of TV Distribution Call for Evidence is largely based on our experience of audience demands and viewership for streaming services ("OTT services") that we support at MainStreaming. We provide our content delivery network (CDN) services to internationally recognised brands like DAZN, RAI, ERT, and Sky, as well as many regional TV and radio broadcasters, live event streamers, and various specialised media & entertainment companies. We have specific insight into the streaming delivery of some of the largest OTT services in the UK primarily through our strategic partnership relationship with Arqiva. Our general exposure to and knowledge of the media streaming industry also supports our overall perspective.

Question 1 response

We note that audience demand and expectations have the following characteristics:

- VOD (Video on Demand) content is viewed more than Live or Linear content on OTT services that have larger VOD libraries (e.g., national broadcasters). Approximately 70-80% of content viewed is VOD.
- Audiences expect convenience of content access, to effortlessly switch between different device types (e.g., mobile phone vs. television). Convenience of content discovery is increasingly a demand based and is accentuated as the proliferation of OTT services and content continues.
- Free, advertising-supported OTT services are growing in popularity as household budgets reach their limits for subscription-based OTT services.
- Live content on OTT services should be delivered with lower latency to keep pace with other platforms that report live information, such as terrestrial and pay-TV services, radio services,

	social media apps, and other apps (e.g., sporting apps). • Quality of video delivery is expected to be better than in the past. As SmartTVs / Connected TVs become more prevalent the number of people viewing OTT services on big screens increases and the expectations of consistently high quality and low latency video delivery increase with it. Leading OTT services like Netflix and Amazon Prime are recognised for their investments in technology that support high quality delivery performance. National broadcasters will need to match this as audiences grow on their OTT services. • Quality expectations for subscription-based OTT services are currently higher than ad-supported OTT services. One of our subscription-based customers notes that a 1% improvement in their Quality of Experience metrics yields a 1% increase in audience viewing time. This is highly significant for both subscription-funded services and advertising-funded services. • Ease of content discovery for consumers between individual content provider OTT services is a long-term requirement from consumers. We see that Internet Service Providers (ISPs) are likely to take the role of general content aggregators across free-to-air content as well as paid-for content. We expect EveryoneTV to play a central role in the free-to-air TV ecosystem.
Q2. 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?	Confidential? – No Audience trends should have multiple effects on the **financial prospects** of TV distribution platforms which includes free-to-air and Pay-TV services. Our response here is based on our experience and insight into the D2C (Direct to Consumer) OTT streaming model. In general, our view is that D2C streaming growth should increase overall profits for Content Providers (e.g., broadcasters and media & entertainment businesses) by creating more valuable viewers (from a subscription and/or advertising perspective) and by reducing total distribution costs compared to traditional methods. While, for traditional Pay-TV service providers that have been providing bundled Pay-TV services via satellite, IPTV and Cable TV (e.g., Sky, BT, and Virgin Media) we could expect that D2C Streaming would reduce overall video service revenues but increase data/connectivity service revenues.

It is clear to us that Pay-TV service providers are currently retaining an important role in the distribution and aggregation of video services for consumers, but how this evolves over time given the expanding position of Smart TV / Connected TV manufacturers operating as aggregators (e.g., Samsung, Panasonic, Sony) is hard for us to predict.

Following are some examples of how revenues and profits could change for different players in the content distribution chain:

- Targeted advertising related to more personalised streaming video services should create more valuable advertising spots for advertisers and better advertising revenues for all types of advertising-funded video service providers.
- FAST channels – which in essence offer a more niche and personalised form of traditional linear TV channels – could create more focused viewership for brands that seek to reach tightly-defined audiences with their content and their advertising. FAST channels should create extra benefits to content providers and video service providers through targeted advertising.
- The IP streaming delivery model creates the opportunity to integrate a wide range of other revenue-generating businesses into the core media business model (e.g., e-commerce, gaming, immersive viewing, betting). This integration could be implemented by content providers and/or by video service providers.
- We see higher total distribution costs for content providers for the period over which D2C streaming services are scaling up and traditional distribution models are scaling down. At some point in time, lower total distribution costs should be expected due to the shared cost nature of using IP delivery over the internet (shared by consumers paying for internet access services and content providers paying for content delivery services). We would expect that IP delivery over the internet becomes very close to 100% of distribution at some point in time, mixing fixed line and mobile broadband connections. In the long-term we see that Satellite-based delivery could play an important role for the most remote locations but we believe that most content delivery will be best served by telco-based broadband connections. In the mean-time, a hybrid multi-platform delivery model seems to be required.

From a **Sustainability perspective**, we have two opinions to share related to **environmental** and **economic** sustainability.

Environmental Sustainability

We should start by saying that we see energy consumption in streaming video mostly driven by the devices and home equipment that consumers use to receive and view content, rather than the network that the content traverses which is a multi-purpose network homogenously deployed for almost every form of digital communication and interaction that we have, and by no means only for our consumption of media content. We would therefore like to see a streamlining of devices that are deployed in homes to reduce energy use in the overall ecosystem. We would also defer to our industry colleagues and partners at the Greening of Streaming for further details about energy consumption related to streaming delivery.

We would like to focus our comments on the method of delivering streaming video and the energy efficiency and/or likely usage of these methods.

To deliver both VOD and Live video at scale – whereby VOD is the majority of viewing – requires a correct blend of both streaming and storage capacity. Most of the content delivery needs to be unicast-based for the 70-80% of total consumer consumption that is VOD. Unicast is also required to support other personalised services like timeshifted TV (i.e., the ability to pause, rewind, fast-forward, and restart a programme), FAST channels, and targeted advertising. Unicast requires a level of CDN capacity to be deployed that can deliver individual personalised streams per viewer to the overall audience. If 1 million people view in Unicast, then the CDN must be dimensioned to support 1 million people multiplied by the average bitrate the audience is requesting.

A smaller amount of consumption (if measured in hours viewed and Bytes of data delivered) but typically a higher peak of a single broadcaster's overall audience size will be driven by Live video consumption. For this form of delivery, it is conceivable to rely on Multicast as well as Unicast. Multicast reduces the amount of total CDN capacity required but requires additional video delivery components to be installed in ISP networks and consumer premises equipment at significant extra cost.

"A single broadcaster" is emphasised above because at MainStreaming we look at a scenario where *all* Content Providers will need to access streaming capacity on a daily

	basis for their content delivery (i.e., the 100% IP Streaming scenario). In this scenario we expect a relatively fixed and predictable number of streams to be delivered on a daily basis, shared between all of the Content Providers across live and VOD content types. This is based on the number of concurrent viewers, or more accurately based on the number of concurrent devices, that are streaming content. Therefore, by understanding population sizes and viewing habits, we know the total streaming capacity required across all content providers. And we also know if the capacity is used by content provider 1 on Monday, then it may be needed by content provider 2 on Tuesday. Or even more granularly, it may be required by content provider 1 at 8pm on Monday and content provider 2 at 9pm on Monday. It is likely that this viewership is still mostly VOD content because of the on-demand nature of our viewing habits. But for the UK, as in each country facing this situation, there will be a fairly predictable daily peak audience that utilises a certain maximum level of capacity. Special live events that drive large peak audiences on a single broadcaster's channel would normally not exceed the total daily viewing population that is shared across Content Providers under normal conditions. Therefore, when we reach the point of 100% IP Streaming, we can envisage that a unicast-based CDN model should be both more useful for the majority of our viewing (i.e., VOD), and simpler to implement and maintain at a national level for the benefit of all content providers. Multicast is a choice for an ISP to make given they must implement the necessary infrastructure throughout their network, and then it will be a choice for a content provider to deliver a multicast source feed. We can foresee situations where this might be commercially viable, although we would advocate that a unicast video delivery model can be optimised for capacity and energy consumption more simply as it does not require the deployment of specialised network infrastructure nor specialised consumer premises equipment. It simply requires Edge servers to be deployed closer to consumers, which in itself will create the ability for other IT/media services to be deployed in a more distributed and efficient way. In summary, we think that the CDN model with deeply-deployed Edge servers using Unicast methods that are close to consumers will be the most energy efficient model for the future of 100% IP streaming. We also think that a hybrid model of IP streaming and over-the-air content delivery, while perhaps necessary for reasons of national security or service resiliency, may not be the most energy-efficient method of delivery considering the general trend

towards the use of broadband/mobile IP-networks and the 2022 Carnstone report's conclusions.

We are therefore keen to explore a potential real-estate model for deploying Video Edge servers using the existing Exchange buildings operated by BT Openreach. In the past 20-30 years these buildings have already transformed from hosting large analogue telephony systems to hosting much smaller digital data systems. We think these buildings could be the physical locations of a full national-scale video caching and streaming platform. We understand BT Openreach is in the process of consolidating from 5,600 to 1,000 total Exchange locations in the UK through the Fibre to the Premises programme. From our MainStreaming perspective this represents an excellent opportunity for locations to host highly energy-efficient and sustainable video streaming infrastructure.

Economic Sustainability

MainStreaming's perspective on this subject relates to the cost of streaming delivery, which is our area of expertise. From our analysis we expect the total cost of streaming delivery for a Broadcaster to be less than the total cost of the same Broadcaster's terrestrial delivery (e.g., DTT transmitter masts/towers). This is because the streaming delivery networks are co-paid (i.e., both the sender and receiver pays) and are more multi-purpose than DTT networks.

As we look towards a future in which Broadcasters and other Media businesses stream 100% of their content, we can envisage broadcast-grade, high-capacity video networks implemented within the overall internet/ISP ecosystem specifically for the delivery and processing of video. These networks have the potential to stream at higher qualities (e.g., 4K, Virtual Reality, etc.), and at lower latencies (e.g., under 5 seconds), and at lower cost than today's media distribution services can achieve. The basic technologies already exist today to do each of these things, although delivering them at-scale to large audiences is not viable for broadcasters. The video delivery architecture embedded in the overall internet ecosystem needs to evolve over time, in partnership with broadcasters and ISPs, to achieve these potential service improvement outcomes for UK prime-time audiences that number in the tens of millions of people.

Key Decision Points

Over the next 10 years, our view of the key decision points includes:

- The outcome of the 2023 World Radio Conference. If the Conference opts for a co-primary allocation we may need to accelerate the implementation of IP-streaming capacity.
- The BT Openreach roll-out of fibre to the premises. When this is complete and a satisfactorily high percentage of the population have taken up high-speed broadband, then it may be the right moment to make the full switch from DTT to IP.
- General access to affordable broadband for the population. This is not our area of specialism, but it seems clear that this will be a pre-requisite before a full IP switch-over can occur.
- Broadcasters' own strategies and drivers to maximise their commercial returns from streaming services. Because implementing a high-scale CDN does not require any generic nation-wide investment, it is possible for broadcasters to take control of their own situation and work with CDN partners and ISPs to increase streaming capacity for their own needs. MainStreaming's work in the UK with Arqiva is focused on this general industry-level requirement that foresees at least a 1000% increase in total streaming capacity to support prime-time TV audiences. ISPs will need to ensure core network capacity is expanded accordingly, but with the UK's average broadband speed per household already exceeding 50Mbps which is sufficient for high quality video delivery to a device, it is conceivable that broadcasters could begin to easily reach >50% of their total audience via streaming services in the next few years based on rolling out more CDN capacity to meet their own needs (as Netflix, YouTube and other leading streamers have done, including the BBC with their own BIDI CDN platform). Please note that:
    - ...MainStreaming has direct experience of this approach in our work for DAZN on the DAZN Edge platform (powered by MainStreaming's technology and services), where DAZN needed to implement video streaming capacity faster than general CDN/ISP market supply could provide, due to DAZN's own need to deliver streaming services to large audiences. Our 2023 whitepaper "Broadcast-Grade Streaming" includes a 5-page DAZN case study that expands on this subject: https://mainstreaming.tv/2023/02/01/the-

	ultimate-guide-to-broadcast-grade-streaming/ ○ …Sky moving away from supplying new satellite dish installations and instead focusing on their all-IP streaming future is another example of the shift towards a majority of viewers using streaming services (note that Sky Italia is a customer of MainStreaming). ○ …These types of commercial decisions will naturally drive more streaming demand, and the need for more delivery capacity. - NetZero deadlines set at government level, with direct support required from PSBs, may drive a priority to switch off some legacy network types sooner and only leave streaming-based delivery to reduce total energy consumption.
Q3. How do broadband networks and supporting infrastructure need to evolve to support resilient delivery of TV over the internet in the future?	Confidential? – No Building on the information provided in our response to Question 2, there are a range of points to highlight about the required evolution of broadband networks and supporting infrastructure in order to provide resilient delivery of TV over the internet in the future. **Broadband network evolution required to provide resilient delivery of TV over the internet:** - Fibre deployments should be universally available to allow for the best possible video streaming performance. Copper components should be generally replaced. - Mobile networks should have a universal minimum level of 4G, able to support the lower bitrate streaming required by most people when using mobile devices connected to cellular networks. - Mobile devices in the home using WiFi, including Smart TVs / Connected TVs that are attached via WiFi, will need to be supported by reliable home routers and home networks to ensure uninterrupted delivery of TV streams to multiple devices simultaneously. - Connectivity between ISPs and those that use the BT Openreach Access Network (e.g., BT, Sky, TalkTalk) needs to be improved from a video delivery capacity perspective. Edge servers that deliver the video streams requested by individual viewers should be deployed more deeply inside ISP's networks to reduce the load on up-stream ISP core networks and to position the point of stream egress from the Edge server closer to the viewers.

This "deeper positioning / distribution" of Edge server capacity will remove or reduce points of network congestion and traffic bottlenecks that today can interrupt the smooth flow of video delivery and will also lead to smaller points of failure in the networks which will have lower impacts in moments of network outage.

- In the long-term, there is a potential argument to create the final layer of the Video Edge Network in the c. 1000 Exchange buildings that BT Openreach will have when the current FTTP Programme is complete. This could be designed as a multi-ISP layer whereby single video streams or video files that exist in the Video Edge Network infrastructure can be delivered from a single Edge server to any viewer on any downstream ISP broadband connection. This architecture may be challenging to implement from a regulatory or commercial perspective, but from a technical perspective we believe it is feasible. If implemented, this architecture could provide the optimal platform for the resilient delivery of TV over the internet.

Supporting infrastructure evolution required to provide resilient delivery of TV over the internet

- IP Routers in ISP core networks may need additional capital investment to manage the higher levels of concurrent viewership on streaming services. Each ISP needs to evaluate their own infrastructure position. We find that some ISPs do not have a big concern while others have larger investments to make.
- CDN infrastructure should be enhanced, per earlier statements. It is likely that capacity currently used by Broadcasters needs to be expanded by approximately at least 10 times to support future audiences. And it may need overall expansion of 20-30 times to offer full UK coverage that allows people in any specific region to receive high quality video simultaneously should they happen to demand it together. We have experience with our largest customers of managing regionally popular events, where audiences are highly concentrated into regional locations. These events require locally deployed capacity to guarantee highly resilient TV delivery that does not suffer from rebuffering, poor latency, or degraded bitrates.
- CDN infrastructure should be deployed in more distributed and granular locations, much like the existing telephony and broadband networks have

	been deployed in Exchange buildings. The exact topology should be decided by ISPs and network service providers who have the ability to exactly define the necessary bandwidth capacity. But in principle, given the c. 1000 Exchanges that BT Openreach intends to have when the FTTP Programme is complete, the video-centric CDN infrastructure for the future of IP streaming delivery should be able to utilise the distributed infrastructure to optimise delivery performance, resilience, and cost. - CDN infrastructure could reasonably be aggregated for use by multiple large video streaming providers where peak audiences shift between media providers – e.g., the PSBs and other large streaming video providers in the UK. If a single, independent, regulated, video-centric CDN service provider existed to aggregate content delivery on various network types, thereby ensuring best possible economies of scale for the broadcaster industry, then it would also optimise the energy efficiency of the overall platform for handling the high-bandwidth usage of video delivery. Arqiva is the example of this in the UK today for terrestrial TV and radio broadcasting, and a similar model could provide the appropriate level of cost, performance, sustainability, and national security in a 100% IP streaming world. This type of organisational structure would need to allow for new technologies to evolve and innovate to optimise video delivery efficiency and sustainability, working on behalf of the Media industry with its ISP and Regulatory stakeholders.
Q4. In what ways might different types of 'hybrid' terrestrial and internet services deliver benefits for audiences and what risks may arise?	Confidential? – No MainStreaming has two areas of input for this Call for Evidence related to "hybrid" services – **HbbTV** and **DVB-I**. **HbbTV** allows a broadcaster to deliver their channel/content via an OTT/IP stream alongside the DTT channel. The HbbTV service allows broadcasters to interact with the viewer via the IP return path, and to monetize targeted advertising. It also allows viewers to utilise video playback features like pause/rewind/fast-forward (i.e., "Timeshifted TV") and have access to the broadcaster's VOD library. We have observed in practice that these benefits are valued by both national and local broadcasters.

	We do not see any specific obstacles to the broader adoption of HbbTV by broadcasters or viewers. From a streaming delivery perspective, it uses standard DASH and HLS protocols to deliver content into the broadcaster's App. The single criticism we have heard so far about HbbTV is that the broadcaster needs to pay a specialised Systems Integrator to make their application available in specific SmartTV / Connected TV platforms, and currently this has a relatively high cost. We would finally note that the next HbbTV event is to be hosted by EveryoneTV in London in 2024, following the 2023 event that was hosted in Naples, Italy. **DVB-I**, unlike HbbTV, can be delivered in the absence of a DTT signal. However, DVB-I relies on agreed standards between the broadcast industry and the TV manufacturer industry. It also relies on specific infrastructure to be deployed in the video distribution chain. We see DVB-I as more technically and commercially complex than HbbTV. DVB-I enables a TV to become interactive, allowing channel list position and app positioning to be changed by the TV manufacturers. This is problematic to public service broadcasters unless their position in the channel line-up or on the home screen is protected by law, because otherwise prominence can be sold to the highest bidder. Due to this broadcaster resistance to adopt DVB-I without the necessary legal protections, we have heard some TV manufacturers stating they plan to wait until each country has agreed on their plans to implement DVB-I before they will complete their TV designs and move into production. *Note that these opinions are based on anecdotal evidence from the industry and not specific empirical evidence.*
Q5. Given the sharing of infrastructure, what would the implications for other sectors be if there was a change to the use of digital terrestrial television (DTT)?	N/A in MainStreaming's response.
Q6. What coordination and planning across the value chain might be necessary to secure good outcomes for audiences and key providers over the long term?	Confidential? – No MainStreaming's opinions on this matter are based on a general market view of our customers, their peers, other players in the Internet and video distribution chain, and

the video delivery technology and services that we are specialised in.

From an **audience perspective** we would note the following items that should be coordinated and planned across the value chain:

- Access to affordable high-performance broadband services. We appreciate the points made by other expert organisations that not everyone who can access terrestrial TV and radio services today would be able to afford, and therefore access, the equivalent services in an IP streaming environment. To address this requires a joined-up effort by government, Ofcom, PSBs and BT Openreach (and other network operators as required) to determine how to address this point. That said:
    - Video can be streamed at a low bitrate – e.g., 3-4 Mbps – and Radio streams at less than 500 Kbps. A single live channel or single VOD asset being streamed to a household would require a very low bandwidth if these bitrates were used. The key for the audience experience is that the minimum bandwidth provided to the household is on a *stable* connection that can *consistently* deliver at these bitrates. This is a much less demanding scenario than 4 TVs in a single household streaming in low latency and 4K, which would require closer to 60 Mbps of delivery capacity into the single dwelling.
- In support of the broadband infrastructure, the video services should be delivered over reliable, high-performance streaming delivery infrastructure, which would incorporate the CDN infrastructure (i.e., servers that process and deliver the video from within the networks) and the connectivity between the CDN servers and the consumer which includes a range of IP routers and switches that should have the necessary capacity to support the full national audience. Our view on required capacity in the UK is as follows:
    - A major national televised event attracts approximately 30 million concurrent viewers. If each viewer streamed at an average bitrate of 10 Mbps (some will stream at 20 Mbps, some at 3 Mbps) then total capacity required would be 300 Tbps (terabits per second). Today's largest peaks reported by the BBC and ITV for

important sports events have served about 2-3 million people on streaming platforms with capacity usage of about 15-25 Tbps. To reach 30 million concurrent viewers/devices, we therefore need to consider deploying a system that has capacity 10-15 times greater than is available today (i.e., 200-300 Tbps). This requirement is evidently on top of other internet use that will be happening simultaneously. Video streaming capacity that can support this requirement should be deployed close to consumers to spread out the network load and not congest core network links.

- If we assume a situation where large regional audiences exist (e.g., Scotland, Wales or Northern Ireland reach the finals of a large international event; or a sporting derby draws in a super-concentrated local audience; or important local news attracts a large local audience), then we would need sufficient capacity in the local region. This might justify the deployment of capacity in a local region to support the whole local population. In that case, at a national level, it might be necessary to build out capacity to serve 60 million people x 10 Mbps = 600 Tbps. If deployed at this level, the capacity would also provide redundancy and resiliency in the network under normal viewing conditions. See below for capacity calculations based on CDN servers required.
- If we assume prime-time video delivery every evening already includes all of the channels and VOD content that the UK population views – including Netflix, Amazon Prime, YouTube, Sky, Virgin, and BT TV – then if we were in a 100% streaming environment we would expect to see 10 million+ viewers every evening already. For PSBs and Broadcasters specifically, the sharing of prime-time audiences on an hour-by-hour basis describes how they can also share the use of streaming capacity that is deployed at the full national scale of 300 to 600 Tbps.
- Finally, assuming that a single Rack of servers (c. 2m tall and 0.6m wide) could deliver approximately 1.5 Tbps of video

delivery (which would serve c. 150,000 viewers at an average bitrate of 10 Mbps to each viewer), then the 300 Tbps of capacity to deliver to 30 million concurrent viewers would require just 1 rack to be deployed at 200 sites ("PoPs" or Points of Presence) in the UK. We could consider the 1000 Exchange buildings as potential PoPs. If we compare this with the 1800 towers/masts and 1100 sites required for the DTT network, this seems like a very significant reduction in real-estate requirements, particularly as the goal would be to use space in existing buildings. Note that based on existing BT Openreach Exchange buildings, the 200th largest location by population size (approximately, and only based on our own research from publicly available information) would be a town/city like Milton Keynes, Blackpool, Norwich or Aberdeen with populations of about 225,000 people.

- These calculations assume a certain total population size (or number of connected devices that are streaming video) and a certain quality of video delivery (i.e., bitrate). If population grows, or the number of connected devices increases, or if video quality increases, then capacity would need to be expanded. It is likely that the PoP number would need to increase – for example, if we doubled PoP count from 200 to 400, we could retain a single rack per PoP and stream at an average of 20 Mbps to 30 million concurrent viewers. Even when/if capacity must be expanded, the overall footprint and technical requirements for a 100% IP streaming system still appear favourable compared to alternatives.

From a **key provider perspective,** we would note the following items that should be coordinated and planned across the value chain:

- We would expect to see a managed transition from current distribution platforms to the IP streaming distribution platform as audiences and broadcasters move to IP streaming-based consumption. This hybrid future that will last for an indeterminate number of years needs close and

careful management to ensure the roadmaps for legacy platforms and new platforms are coordinated. This managed transition would enable existing business models to adapt and change as the underlying technology changes.

- We would expect to see a coordinated approach of this transition with the roll-out of faster broadband services and proactive planned increases in CDN capacity that are coordinated between all parties in the chain.
- We would expect to see ISPs generally developing their IP routing infrastructure to support normal levels of daily concurrent video viewers, so that CDN capacity increases are supported by underlying ISP network capacity increases.
- We would like to see ISPs and Access Network Operators collaborating on how to get the best quality and reliability of video delivery to every viewer. If each household could receive a very consistent 10 Mbps video stream, the quality of the image on larger TV screens would be much more satisfactory to each viewer (and from another perspective we would expect this to be better for people's eyes and their enjoyment of the content they are watching).
- A more futuristic consideration that will require Ofcom oversight is to make the UK's "IP Video Delivery Network" a multi-ISP platform, bringing it to a similar regulatory position as the BT Openreach network or the Arqiva DTT network. This would enable the deployed infrastructure to be more efficient in serving the entire UK population compared to separate ISP-deployed or IXP-deployed CDNs (IXP = Internet Exchange Provider, such as the LINX). It would achieve this by serving live, linear and VOD content from a single Edge server to multiple viewers across multiple ISP networks, from a position that is between the ISP Core Networks and the Access Networks. It is much like "peering" happens today from a single CDN Edge PoP hosted at the LINX (for example) into multiple ISPs, but it works in reverse by "peering" from multiple ISP networks via a single CDN Edge PoP into a single or multiple Access Networks. This is moving the peering point further downstream in the video delivery architecture. This significant commercial and operational change (note that it is not a significant technical change) in CDN architecture would probably require Ofcom's regulatory direction and the establishment of a regulated specialist video

	delivery entity (like Arqiva) to manage the CDN infrastructure and the national services that run across it. Technologically, advances and innovations would still need to be made to find new efficiencies as video formats evolve, but the base platform for highly resilient and optimally efficient video delivery would be in place.

Please complete this form in full and return to
FutureofTVDistributionCallforEvidence@ofcom.org.uk