

DIGITAL



January/February 2019

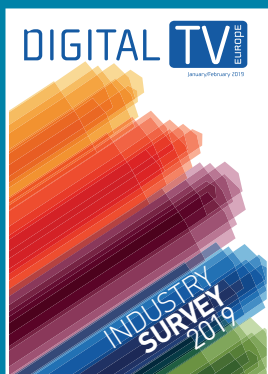
The background of the cover is composed of several overlapping, semi-transparent geometric shapes, primarily triangles and polygons, in a variety of colors including shades of orange, red, purple, blue, and green. These shapes are arranged in a way that creates a sense of depth and movement, with some shapes appearing to be layered on top of others.

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The vision thing



Digital TV Europe's fourth annual survey once again reveals what top industry executives think about the prospects and likely future shape of the digital video distribution business. This year, the overarching theme of the survey is delivery. This encompasses the growing use of cloud technology, the evolution of the user experience, service providers' options in consumer premises equipment, hybrid broadcast and broadband deliver, the evolution of OTT to embrace mass audience live-streamed events, and the evolution of broadband networks over which OTT TV services are delivered.

560 industry executives from 64 countries answered our call to share their views on the seven topic areas of this year's survey. Respondents, surveyed online between December and January, ranged from pay TV and OTT TV providers, broadcasters and content aggregators to technology providers.

Those seven topics include our overview of the digital TV landscape, providing a snapshot of perspectives on the key trends and developments. The survey also drills down into the evolution of TV operators' infrastructure towards the cloud and virtualisation, summarising perspective on the opportunities and challenges service providers face as they migrate their technology platform to accommodate shifting patterns in consumption.

We then take a look at the user experience, and the importance of this as a differentiator for service providers in an age when content offerings are converging, and as a crucial tool to enable consumers to navigate the perplexing wealth of content now available across broadcast and OTT TV platforms.

Next, we look at the consumer premises options facing service providers as they battle it out in an ever-more competitive environment in which cost and flexibility are at a premium.

We then look in detail at one specific and widely deployed technology platform – HbbTV – that is seen as key for the future of over-the-air distribution, but which also has new and emerging applications for service providers.

We once again look at the issues surrounding live-streaming, particularly in a world where online distribution of high-profile sporting fixtures has become a mass-market phenomenon.

Finally, we look at the evolution of the broadband networks that are a crucial part of the OTT TV delivery puzzle.

The survey results, once again presented in full, offer our readers a wealth of data about how industry leaders view the challenges and opportunities ahead.



Stuart Thomson, editor

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The digital TV landscape

Introduction

The delivery of TV services is undergoing massive transformation, driven by changes in technology and consumer habits.

These changes – the increasing importance of cloud technology in delivering video and the growing preference of consumers to view content on multiple devices and at a time of their choosing – are having an impact across the entire video ecosystem. They are leading among other things to the partial disaggregation of pay TV services (and the possible re-aggregation of SVOD services), the growing importance of a user experience that facilitates search across multiple sources of content and the widespread use of OTT delivery even for linear channels.

Digital TV Europe's fourth annual industry survey assesses industry views of key aspects of the changing environment, including the concept of the virtual operator, the evolution of the user experience, the growing popularity of new technology choices for operators such as Android TV and BYOD, the use of HbbTV as a way to extend the life of terrestrial TV platforms, the rise of OTT live streaming and the growing importance of ultra-fast broadband networks to deliver content.

To kick off, however, we asked survey respondents to take an overview of some of the key changes having an impact on the video distribution business, including the rise of OTT TV and the perceived decline of pay TV.



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The digital TV landscape

Pay TV v OTT TV

The big takeaway from this year's *Digital TV Europe* Industry Survey is that traditional pay TV is on the way out and OTT TV's star is continuing to rise. Respondents overwhelmingly believe that OTT TV is set for growth and pay TV will decline either in terms of absolute numbers, or relative to OTT TV.

Asked about the relative prospects for growth in pay TV and OTT TV, some 42% of respondents said that OTT TV services will grow and pay TV services will decline, while a further 31% said that OTT TV services and pay TV will both grow, but the latter will grow at a slower rate.

The next biggest group – some 22% of respondents – think that pay TV and OTT TV will converge, rendering any distinction between them meaningless.

Only a small minority of respondents endorsed other viewpoints. Some 2% believe that OTT and pay TV will grow at the same rate, while fewer than 1% are of the view that pay TV will grow and OTT TV will decline. Some 2% believe that both OTT TV and pay TV services will decline. (fig. 1)

The shift away from pay TV to OTT TV is being driven by a number of factors, but a migration of viewing to time-shifted and on-demand content and from the big TV screen to multiple screens looms large, alongside the perception that OTT TV services provide greater value than traditional 'big bundle' pay TV.

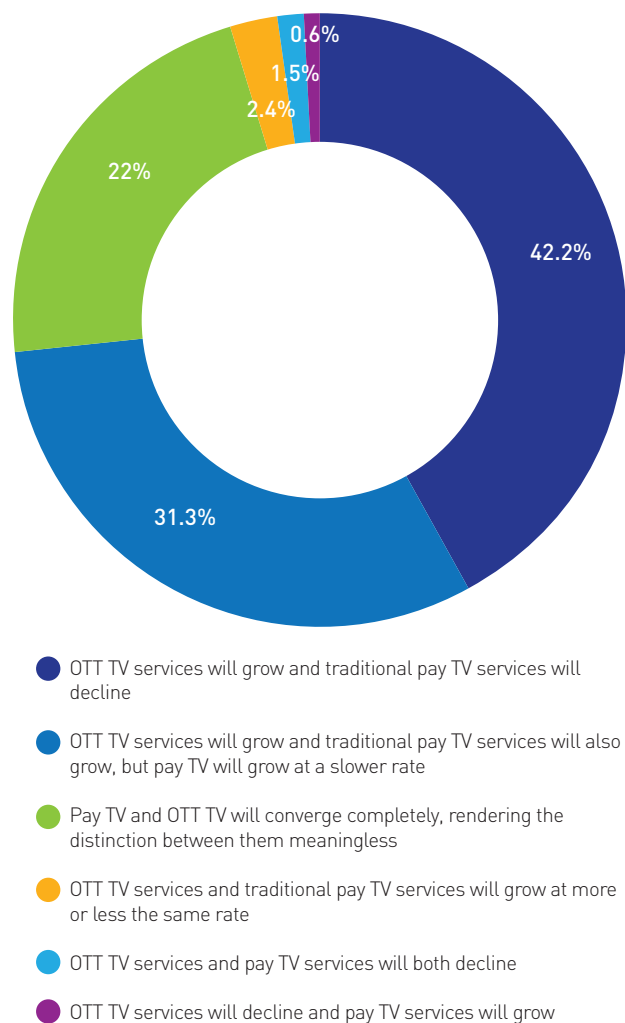
This migration of viewing habits is accorded huge significance by our survey sample, and it is seen overwhelmingly as a positive trend. Asked which of a set of seven industry trends or developments would have the greatest impact on the global digital TV business over the next two years, half said that the shift in content consumption from linear to non-linear video and from TV to multiple screens would have a strong positive impact, with a further 35% saying it would have a moderate positive impact.

Respondents also took the view that the launch of direct-to-consumer OTT TV services by big media companies such as Disney and AT&T Time Warner will have a very positive impact, but have a more nuanced view of the impact of industry consolidation and the growing power of big tech companies in media. While 26% think that consolidation among big media companies such as Disney and Fox to enable them to compete with web-based technology giants will be strongly positive, a similar number believe it will either have a moderately negative or a strong negative impact.

Similarly, opinions are somewhat divided over the growing market power of internet companies such as Google, Amazon, Facebook and Apple. Initiatives by traditional broadcasters such as the BBC, ITV, France Télévisions and TF1 to launch SVOD services to combat the growing power of Netflix and Amazon, on the other hand, are viewed as having a moderately positive impact by an absolute majority – 57% – of respondents.

The trend of pay TV cord-cutting – or never signing up for a pay TV service in the first place – and towards à la carte consumption and service stacking is seen as strongly or moderately positive by a majority of respondents, but a third of our survey sample think, on the contrary that it will have a moderately or strongly negative impact.

Fig. 1 Which of the following statements best expresses your opinion about the prospects for pay TV services globally over the next two years?



Respondents were less enthusiastic about the impact of the disruption of traditional rights agreements with sports bodies and other entertainment producers retaining their own rights or selling them to new entrants. (fig. 2)

We also asked respondents to rate five different technology-related developments in terms of their positive or negative impact on the digital TV landscape. Our survey sample voted overwhelmingly in favour of the impact of the accelerating expansion of broadband infrastructure and investment in ultra-fast broadband networks such as fibre-to-the-home, with over 57% endorsing the view that this will have a strong positive impact and 35% believing it will have a moderate positive impact.

Respondents are also broadly in favour of the migration of broadcasters

Fig. 2 Which of the following commercial and consumer developments will have a big impact on the global digital TV business over the next two years?



The shift in content consumption from linear to non-linear video and from TV to multiple screens



The launch of direct-to-consumer OTT TV services by big media companies such as Disney and AT&T Time Warner



Consolidation among big media companies (e.g. Disney and Fox) to enable them to compete with web-based technology giants



The growing market power of internet companies such as Google, Amazon, Facebook and Apple



Cord-cutters, cord-nevers and the trend towards à la carte consumption and 'service stacking' by consumers



Initiatives by traditional broadcasters such as the BBC, ITV, France Télévisions and TF1 etc to launch SVOD services to combat the growing power of Netflix and Amazon



Disruption of traditional rights agreements with sports bodies and other entertainment producers retaining their own rights or selling them to new entrants



and pay TV operators to cloud delivery and TV-as-an-app deployments, eliminating traditional broadcast infrastructure and set-top boxes. The growing use of data analytics to deliver personalised services including advertising is similarly seen as a positive for the industry. A majority of respondents view image and sound quality improvements as having a moderate positive impact.

Opinions are much more divided over the merits of virtual and augmented reality, which may reflect scepticism about the likely adoption of this technology. (fig. 3)

Service offerings and their prospects

Drilling down more deeply into views of the likely future of different types of service offerings, we asked respondents to rate the growth prospects of nine types of service.

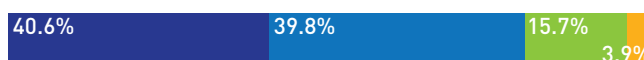
Fig. 3 Which of the following technology developments will have a big impact on the global digital TV business over the next two years?



There will be accelerating expansion of broadband infrastructure and investment in ultra-fast broadband networks such as fibre-to-the-home



Broadcasters and pay TV operators will migrate towards cloud delivery and 'TV as an app', eliminating traditional broadcast infrastructure and set-top boxes



There will be a growing use of data analytics to deliver personalised services including advertising



There will be ongoing improvements in image and sound quality, such as 4K and 8K UHD TV, HDR etc, and the means to deliver them to consumers affordably



There will be growth in the supply of virtual reality and augmented reality experiences



Our survey sample was most enthusiastic about the prospects for subscription video-on-demand services, with 44% saying SVOD has very positive prospects and 49% taking the view that it has moderately positive prospects.

Subscription 'skinny bundle' offerings combining linear and on-demand OTT TV services are also highly rated, with over nine in 10 viewing these as having either very positive or strongly positive prospects.

OTT TV variants such as subscription linear OTT offerings and advertising-based OTT TV in general achieve a positive rating, with significant minorities taking a more negative view.

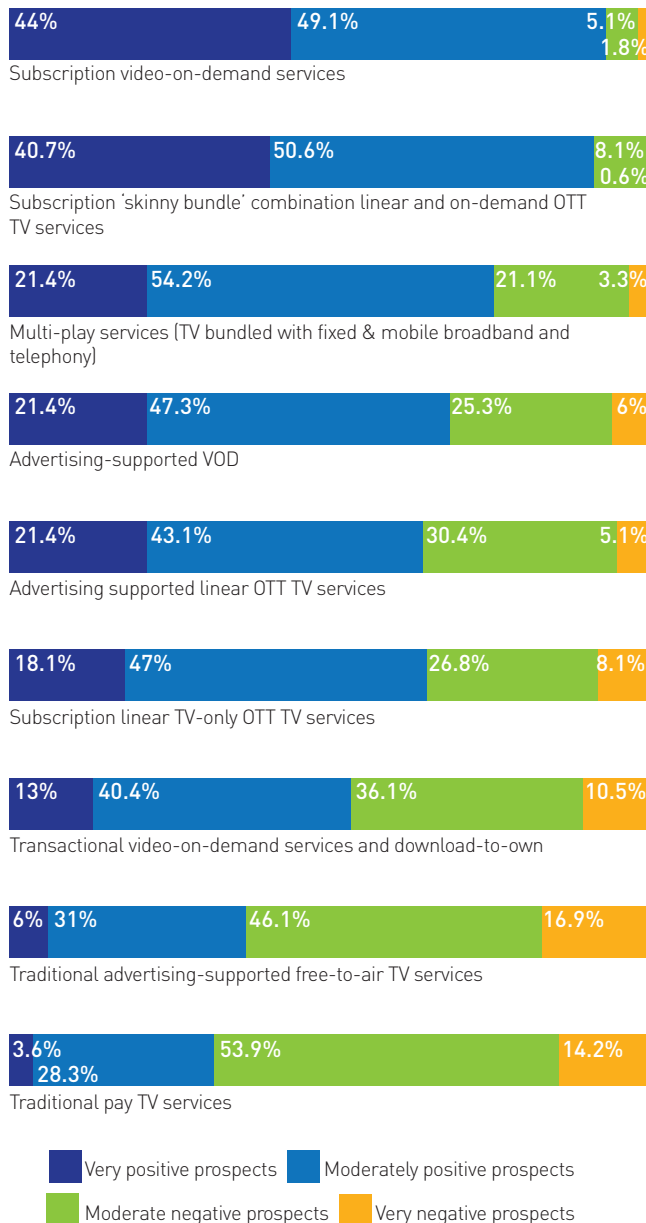
Traditional broadcast services are likely to perform poorly by comparison, in the view of survey respondents. Over three in five believe that advertising-supported free-to-air TV has either moderately negative or very negative prospects.

The worst prospects of all, in the view of our survey sample, are those for traditional pay TV, however. Over two thirds of respondents believe pay TV has moderately negative or strongly negative prospects.

There is some relief for pay TV operators who bundle their services with broadband and telephony as part of a multi-play offering however. Three in four respondents believe these types of service have very strong or moderately strong prospects. (fig. 4)

Finally, we asked respondents to choose the company they believe has made the biggest impact on the business of digital video distribution over the past year. Out of a field of seven candidates, Netflix secured top slot by a

Fig. 4 How would you rate the future growth prospects of the following types of service over the next two years?

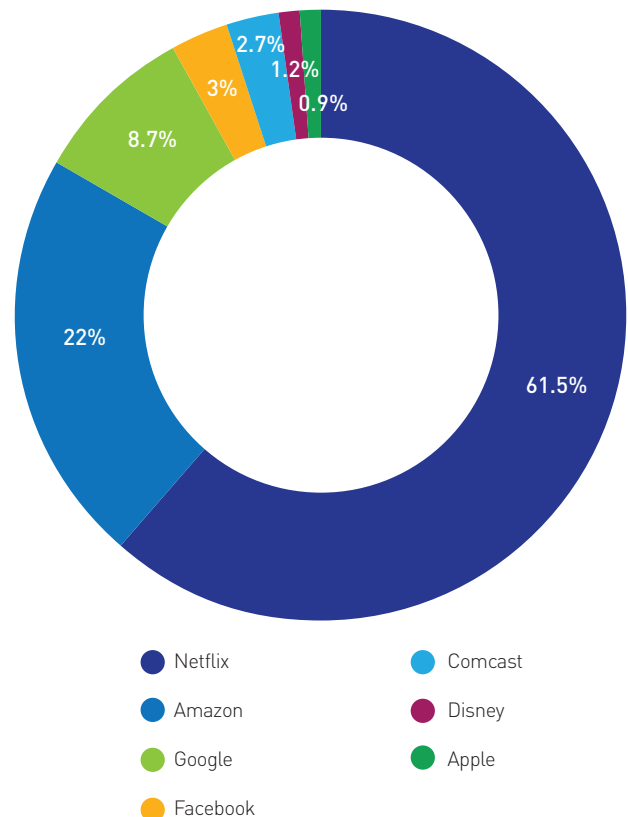


massive margin, with 61% voting it as having the biggest impact.

Netflix's chief rival Amazon came second, with 22% of votes, followed by Google with 9%.

None of the other options on offer secured a large number of votes. Some 3% of respondents believe that Facebook made the biggest impact, with traditional 'big media' companies Comcast and Disney securing 3% and 1% respectively. Bottom of the rankings was Apple, which secured fewer than 1% of votes. (fig. 5)

Fig. 5 Which of the following companies do you think has had the biggest impact on the business of digital video distribution over the past year?



Conclusion

Survey respondents are overwhelmingly of the view that traditional pay TV is declining and will continue to decline, with the partial exception of services that are bundled with broadband and voice offerings. The traditional big bundle pay TV offering is under assault from changing viewing habits, with a shift to time-shifted on-demand viewing and viewing on multiple devices playing to the strengths of OTT TV.

The shift in viewing is seen overwhelmingly as a positive development by survey respondents. Our survey sample is also positive about the impact of the launch of new OTT streaming services by big media companies, joining existing subscription video-on-demand players in the digital space.

Unsurprisingly, the development of broadband infrastructure and investment in ultra-fast networks, which will enable this shift to OTT TV to accelerate, is viewed overwhelmingly positively. Respondents are also enthusiastic about the migration of traditional media and broadcast companies to the cloud, enabling them to handle the shift to OTT TV.

Equally unsurprisingly, SVOD services are viewed as having the strongest prospects in the new digital TV landscape, followed closely by 'skinny bundle' OTT TV combinations of linear and VOD channels. ●

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Towards the virtual operator

Introduction

The use of cloud-based technologies to distribute video is now well-established. The advantages, such as scalability, flexibility and mitigating the risk of launching new services, have been widely discussed at industry forums for a number of years.

Nevertheless, despite the many benefits of cloud solutions, the migration of broadcasters and service providers from their own on-premises infrastructure to software-based systems housed in data centres is still in its early stages.

While the advantages of cloud-based systems – and ultimately the partial or complete virtualisation of a broadcaster or operator's infrastructure – have been widely publicised, the path to the cloud can meet with some initial resistance.

The culture of organisations takes time to shift, particularly if technical staff are accustomed to the perceived sense of greater control provided by on-premises hardware. Organisations can also be challenged by the need to move from a system where infrastructure is capitalised to one where it is treated as an ongoing operational expense. Beyond the internal structure and culture of the organisation itself, doubts also remain about the reliability of service-level agreements and whether cloud-based technology can provide the 'five nines' degree of reliability that video requires.

Nevertheless video delivery is moving inexorably towards the cloud, driven both by cost-consciousness in an increasingly competitive environment and by the changing consumption patterns of viewers that favour cloud delivery.



Harmonic, the worldwide leader in video delivery technology and services, enables media companies and service providers to deliver ultra-high-quality broadcast and OTT video services to consumers globally. The company has also revolutionized cable access networking via the industry's first virtualized cable access solution, enabling cable operators to more flexibly deploy gigabit internet service to consumers'

homes and mobile devices. Whether simplifying OTT video delivery via innovative cloud and software-as-a-service (SaaS) technologies, or powering the delivery of gigabit internet cable services, Harmonic is changing the way media companies and service providers monetize live and VOD content on every screen. More information is available at www.harmonicinc.com

Towards the virtual operator

The impact of cloud technology

Proponents of cloud-based services believe that they will transform the business of operators by minimising costs and providing maximum scale and flexibility to launch new products.

Our survey respondents were more or less evenly split between those who believe cloud-based services will completely transform the business of operators and those who think cloud-based services will deliver substantial benefits but don't deserve the description 'transformative'.

A smaller group of just under 12% of respondents believe that the cloud will deliver only modest improvements for operators. While very few believe that the cloud services will have a negligible or negative impact, a significant minority of about 8% believe the costs and benefits of the cloud are still unclear. (fig. 1)

We asked respondents to rate five key functions and operator assets for the likely impact – positive or negative – of cloud-based services. Respondents believe that the most positive impact will be on the video headend, including video processing systems, content management systems and DRM. Similar numbers support the notion that cloud technology will have a very positive or moderately positive impact on TV applications such as cloud DVR.

Respondents generally believe that cloud-based services will have a moderately positive impact on production and playout systems and on broadband access headend infrastructure – such as CMTS/CCAP equipment, though the impact will not be as great as for video headends and consumer-end apps such as DVR.

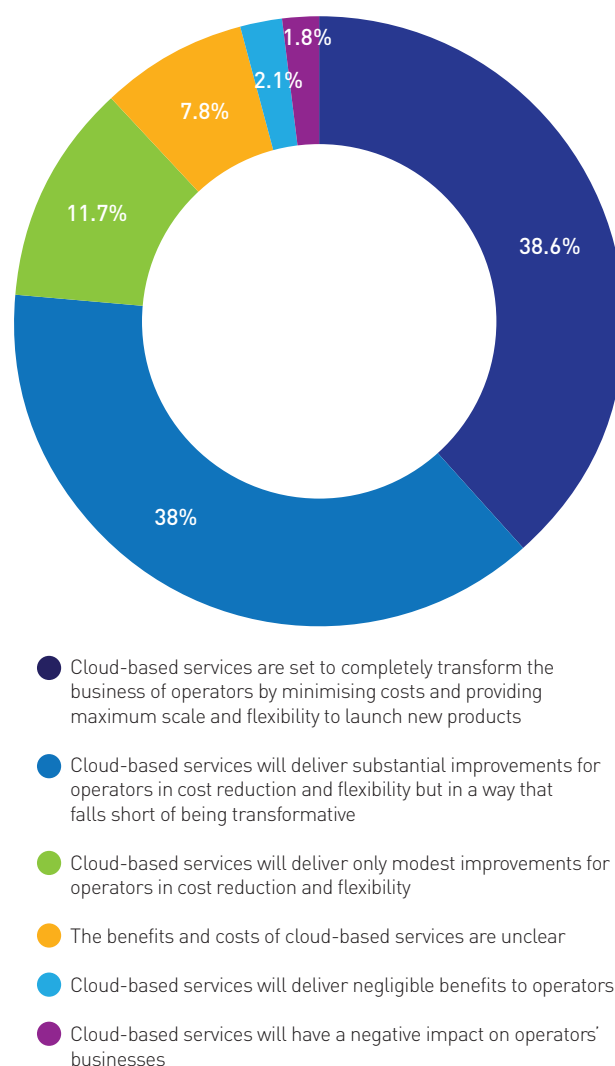
Respondents were less wholly convinced about the positive impact of the cloud on consumer premises equipment. Although a majority still believe cloud-based services will have either a very significant benefit or a moderately significant benefit for CPE, almost one in four respondents believe they will have a moderately negative impact and over 6% believe they will have a very negative impact. (fig. 2)

Our survey respondents exhibited a broad range of opinions about how quickly the five different elements considered would become completely cloud-based. Overall, however, respondents believe that the impact will be felt most rapidly in the area of TV applications such as cloud DVR, with close to 22% believing these will be completely cloud-based within a year.

In general, the weight of opinion among respondents tended to the view that the video headend and production and playout are most likely to be completely cloud based within one to three years. Our survey respondents were more or less equally divided on whether this would happen towards the first or second half of that time period. A minority of respondents believe that cloudification will come to pass sooner, while a larger minority believe it will happen later.

Opinion is more divided over how quickly broadband access headend infrastructure and consumer premises equipment such as set-top boxes

Fig. 1 Which statement best expresses your opinion about the power of cloud-based services to help TV operators' businesses over the next five years?



will migrate to the cloud. While in both cases the majority believe it will happen between one to three years from now – with an even split between those favouring the first and second half of that time period respectively – significant numbers also believe it will happen later. In the case of CPE, some 13% also believe it will happen sooner, within a year. (fig. 3)

Fig. 2 For which of the following functions and operator assets do you think cloud-based services will deliver a clear benefit for TV operators?

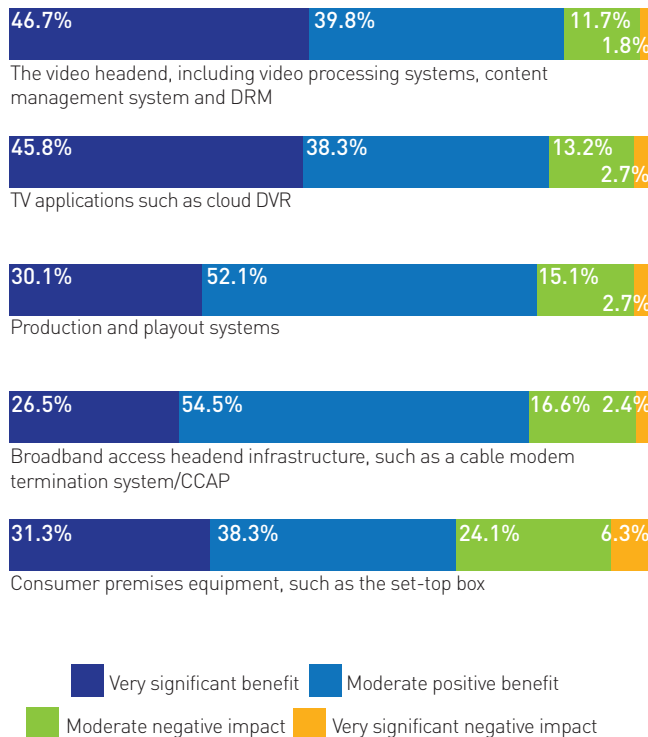
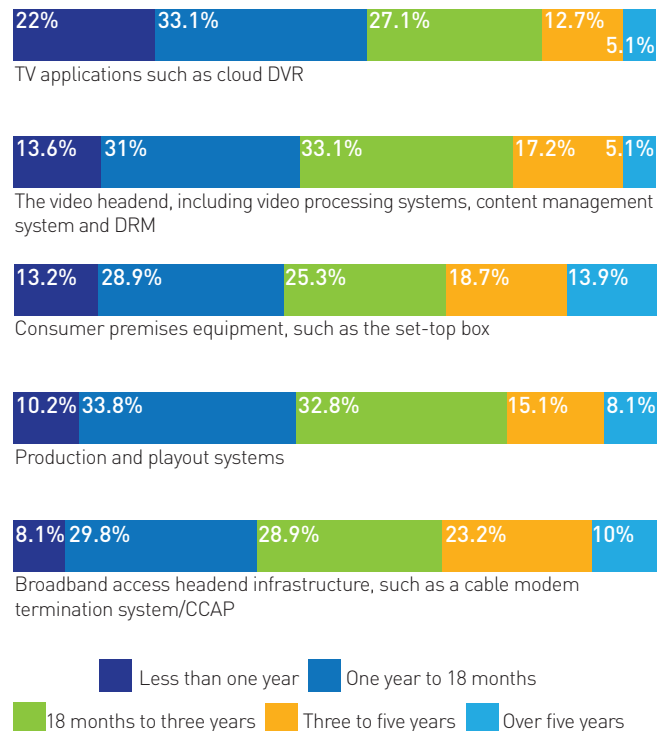


Fig. 3 How quickly do you believe these elements of TV delivery infrastructure will be completely cloud-based?



Advantages and challenges

We asked our survey respondents to identify what they believe are the major advantages of delivering TV services using cloud technology.

The responses show that most view scalability to be the single biggest benefit conferred by going to the cloud. Over two thirds of respondents believe that cloud-based TV delivery confers a very significant advantage in terms of scalability, enabling providers to meet growing demand for services without making big upfront investments in infrastructure.

The second biggest advantage of migrating to the cloud, in the view of respondents, is time to market. Close to three in five respondents believe that cloud-based technology provides a big advantage to service providers by enabling them to roll out new services and make changes to existing services, with a further 32% taking the view that this is a moderately significant advantage.

Flexibility is also seen as a big advantage. Over half of respondents believe that the ability of cloud-based providers to try out new services and drop those that fail at incremental minimum expense delivers a very significant advantage.

Slightly less highly rated – but still seen as a significant advantage

– is the ability of cloud technology to enable operators to maximise cost efficiencies. There is somewhat more scepticism about the ability of cloud technology as it currently stands to deliver superior reliability to on-premises infrastructure. Only 30% of respondents think that the cloud will deliver a very significant advantage in reliability, with just under half taking the view that it will deliver a moderately significant advantage and some 22% believing it will either bring an insignificant advantage or no advantage. (fig. 4)

Respondents exhibited less clear-cut opinions about the disadvantages or challenges of moving to cloud technology. Asked to rate six possible challenges or disadvantages, respondents saw a lack of clear standards, and uncertainty about delivering Quality of Service and Quality of Experience compared with traditional infrastructure, as the main challenges, but only by a small margin.

Uncertainty about the quality of service level agreements with infrastructure providers – necessary to support cloud-based services and a fear of loss of control to third-party infrastructure providers had some resonance, with a clear majority believing these to be very significant or moderately significant challenges. Lack of professional in-house expertise is cited as a very significant challenge by 32% of respondents and a moderately significant challenge by 45%.

Curiously, one of the challenges frequently cited as a very significant



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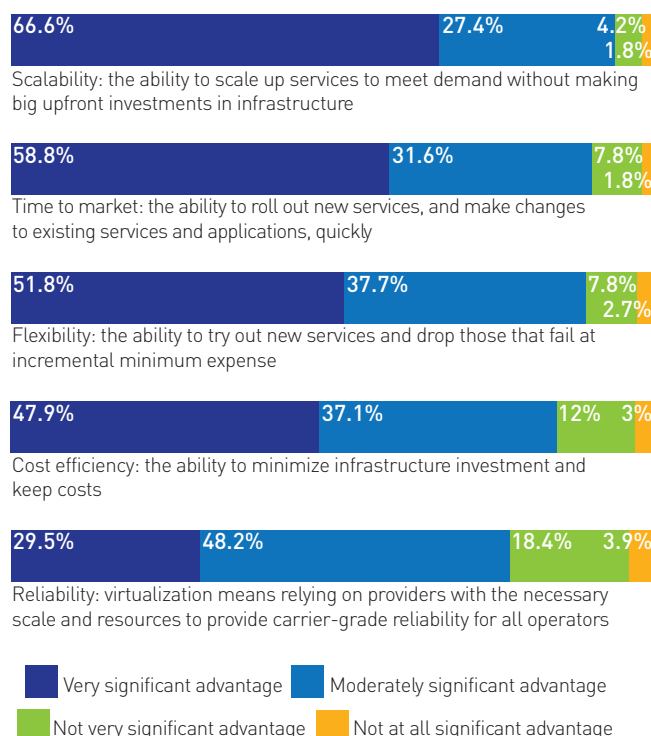


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Fig. 4 What in your opinion are the major advantages of Cloud-based TV delivery?



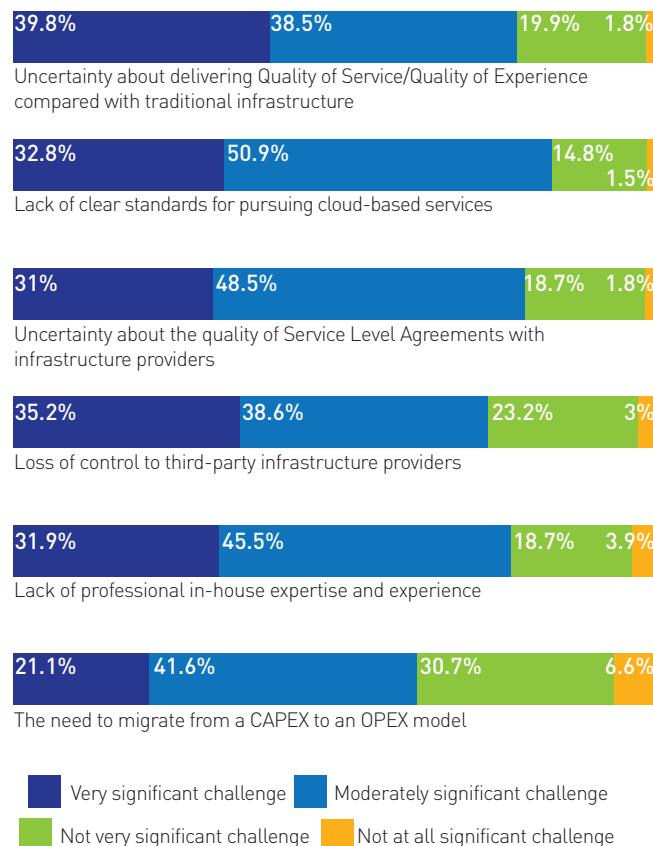
hurdle by industry analysts – the need for organisations to migrate from a CAPEX model to an OPEX model when replacing on-premises infrastructure with cloud-based infrastructure in a data centre – is not seen as a very significant challenge by the majority of respondents, coming sixth out of six on the list considered. (fig. 5)

Cloud potential

On the whole, respondents are bullish about the potential of cloud technology and believe service providers should move quickly to take advantage of these. Asked to choose which of four statements best reflects their opinion about the merits of delivering TV services from the cloud, two in five agreed that it makes sense to deliver some but not all TV services from the cloud now, based on current technology and consumption habits, while three in 10 agree that it makes sense to deliver all TV services from the cloud now.

Some 30% of respondents were more sceptical about the benefits of cloud technology. Some 22% believe it makes sense to deliver some TV services from the cloud, but only advanced TV services such as a UI, DVR, and VOD to older, legacy set-top boxes and receivers. A further 8% believe it does not make sense to deliver TV services from the cloud now. (fig. 6)

Fig. 5 Which of the following present the major challenges or stumbling blocks to cloud-based services?



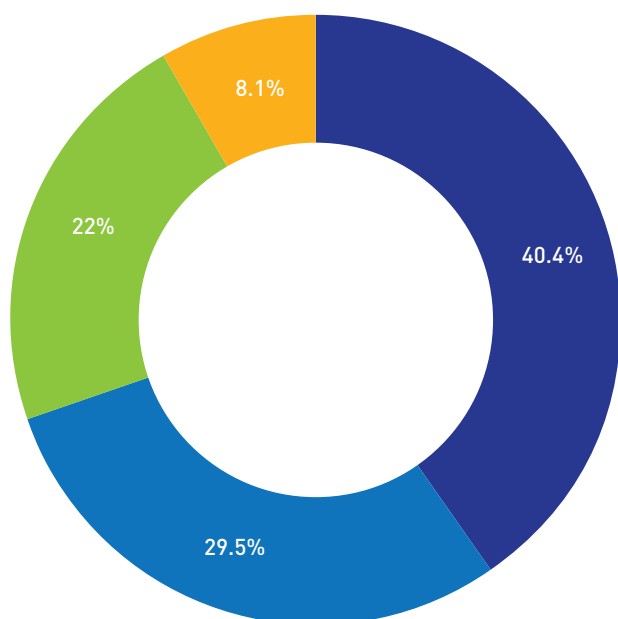
Of the various applications that can be delivered from the cloud, respondents were most enthusiastic about the delivery of cloud-based video on demand, with 72% taking the view that there is a strong benefit of delivering VOD from the cloud.

Digital video recording (DVR) and personalised TV services such as targeted advertising come more or less equal second in terms of applications for which the cloud makes most sense. Over half of respondents believe there is a strong benefit in each case, with significant numbers taking the view that there is a modest benefit.

Respondents in general are of the opinion that headend disaster recovery from the cloud delivers a modest benefit, with the same applying to delivering the user interface or EPG from the cloud. Significant minorities believe there is a strong benefit in both cases. The advantage of delivering production and playout from the cloud is more modest, in the view of respondents, with a significant minority believing there is no benefit (or even a negative benefit) in delivering production and playout from the cloud.

The least popular application for the cloud is linear TV channels. Only 20% think there is a strong advantage in delivering linear channels from the cloud, with twice that number believing there is either no benefit or a negative benefit. (fig. 7)

Fig. 6 Which of the following statements best reflects your opinion about the merits of delivering TV services from the cloud?



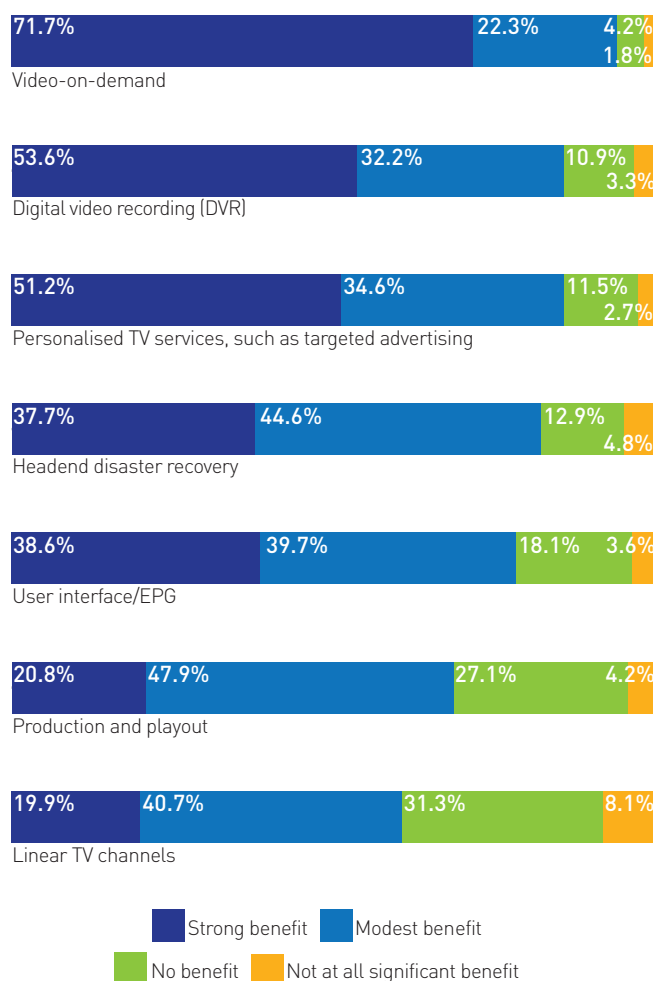
- It makes sense to deliver some but not all TV services – such as DVR and VOD – from the cloud now based on current technology and consumption habits
- It makes sense to deliver all TV services from the cloud now based on current technology and consumption habits for OTT services
- It makes sense to deliver some TV services from the cloud now – but only to provide advanced TV services such as advanced UI, DVR and VOD to subscribers with old or legacy hardware
- It does not make sense to deliver all TV services from the cloud now based on current technology and consumption habits for broadcast services delivered over DTH, cable, terrestrial and IPTV

Conclusion

While the benefits of cloud technology are well-documented, industry participants who responded to our survey were more or less evenly split between whether the impact will be transformative or significant but not transformative.

This variation may partly be related to differences of opinion about which parts of the video delivery chain will see the greatest and most immediate impact of the application of cloud technology. Respondents tend to be of the strong opinion that the cloud will deliver a clear benefit when applied to the video headend – including video processing, content management and DRM – and to certain consumer-facing applications such as DVR. Fewer are convinced that the cloud will deliver a very significant benefit when it comes to cloud technology replacing consumer premises equipment and broadband access headend infrastructure.

Fig. 7 Which applications and services does it make most sense to deliver from the cloud?



Respondents are also divided about how quickly different parts of the delivery chain will migrate to the cloud. While the majority believe that the migration will take place sometime between one to three years from now, opinion is split about whether it will occur in the earlier or later part of that period.

In terms of which applications are likely to migrate to the cloud first, respondents collectively believe that consumer-facing applications such as DVR in particular will take pole position, with cloudification of the video headend and playout and production likely to happen within one to three years.

Despite uncertainty about the timing of migration to the cloud and differences of opinion about the overall impact of cloud technology, there is a broad consensus about the key benefits. These are its ability to deliver scale and fast time to market, along with the flexibility to trial new services and channels at minimal upfront investment or to close them without a major cost impact. ●

The user experience

Introduction

In an age when pay TV operators are under pressure from OTT TV services, many choose to compete on converged bundles rather than by providing unique content. In this environment, the user experience (UX) – the way that content is presented and the tools for navigating and discovering it – is becoming ever more important as a way to differentiate between one service offering and another.

At the same time, deploying a compelling UX is becoming ever more challenging. Consumers are increasingly accustomed to using multiple services – with their own UX in the case of OTT services – and viewing content on multiple devices. TV operators are resource-constrained and have to cater to a wide range of consumer expectations, while offering new tools to enable their users to navigate an unprecedentedly broad range of content sources.



Founded in 2001, Zappware is a Global Player with its headquarters in Belgium.

Zappware provides innovative User Interfaces and video back-office solutions for Telecom Operators, Cable Operators and OTT players. The digital TV solutions are offered as a one-stop-shop to run on any screen, any device over any network: DVB, IPTV, OTT or Hybrid.

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Zappware focusses on bringing the best possible User eXperience while integrating 3rdparty content and innovative technologies in a meaningful way for the end-users.

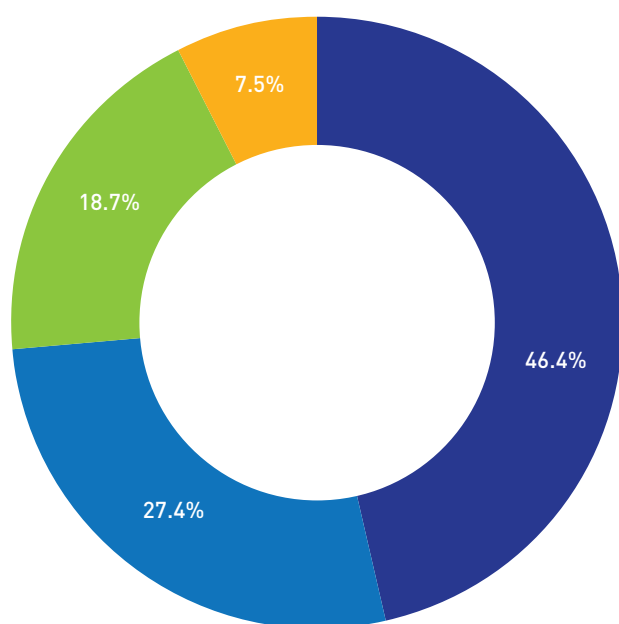
The mission is clear: creating the demand for more video services through an amazing customer experience and fuel the business intelligence to personalize the video service with relevant content and upsell suggestions. www.zappware.com

The user experience

The compelling UX

Survey respondents endorse the view that the UX has a very important role to play in the overall service provider proposition. While only 19% believe that the UX is the most important thing that a TV operator provides – the key tool to differentiate their service – close to half of respondents believe that the UX is equal in importance to the content line-up and other elements as a way to differentiate a service.

Fig. 1 Which of the following statements best expresses your opinion about the role that the User Experience (UX) can play in enabling TV operators to differentiate their services?



- The UX is about equal in importance to the content line-up and other elements in a TV operator's overall proposition: it is an important differentiator as a way to engage subscribers
- The UX is important, but less important than the content line-up and other elements as a way to differentiate a TV operator's service
- The UX is the most important thing a TV operator provides: it is the key tool to differentiate a service and the key tool to engage subscribers
- The UX is of relatively little importance as a way to differentiate a TV operator's service compared with other elements such as the content line-up, price and availability

Only 27% believe that the UX, while important, is of lesser importance to the content line-up and other elements in a service provider's proposition, and only 8% believe that the UX is of relatively little importance as a differentiator. (**fig. 1**)

What then makes a compelling UX? We asked survey respondents to rate a large number of features and functionalities to tease out which elements are more important than others.

Instructively in the age of multiscreen viewing, the single most sought-after feature was the ability to pick up shows from where viewers' left off viewing on one device on another device – so-called 'follow me' functionality. Some 55% of respondents rated this as very important with a further 34% rating it as moderately important.

Other very highly-rated features include having a mobile app that replicates the onscreen TV UX – again an indicator of how much importance is attached by this survey sample to multiscreen viewing – and the integration of on-demand content with the linear channel guide.

Similarly, highly-rated functions include, in order of importance to this survey sample, pause live TV and – a future-looking feature – AI or machine learning-generated content recommendations based on household-level consumption data. The latter was rated slightly more highly than simple algorithm-based content recommendation, which perhaps indicates that the term 'AI' has a certain magic stardust quality to it, but which could also show that there is interest in a more sophisticated way of generating recommendations. However, while AI linked to prior consumption is rated highly, AI-generated recommendations based on mood through face or voice recognition comes absolutely last on our list of features, with more respondents viewing it unfavourably than favourably.

(Both AI and algorithm-based content recommendation based on household consumption also rate more highly than editorial-based recommendation, which comes fifth from bottom in our list of 18 features and functionalities, with only 26% viewing it as very important.)

What might be termed mid-table features – in terms of the importance accorded to them by our survey respondents – includes multiple individual profiles on the main screen, comprehensive text-based search, a now-and-next channel guide (seen as significantly more important than a seven-day channel guide), the inclusion of third-party apps as an integrated part of the UX (seen as very important by 36% and moderately important by 38%), the ability to create favourite lists, and voice control and search. (The latter is seen as more useful than voice-recognition-generated personalised recommendations, which comes third from bottom in order of importance.)

Features (other than those already mentioned) that respondents believe are of relatively lesser importance include recording functionality – perhaps seen as on the way out in the age of universal on-demand content – and personalised advertising. The

latter comes second from last in our list, with only 23% viewing it as very important and a substantial minority viewing it as either not very important or not at all important. (fig. 2)

Profiles and apps

Taking a deeper dive into two increasingly mainstream UX features, we asked survey respondents to give a more nuanced view of the importance of individual profiles on the main TV screen and of

integrated third-party apps.

Regarding individual profiles, we asked respondents to rate the principal benefits. The key benefit of this feature, in the view of our sample, was that individual profiles enable users to restart viewing content from where they left off last time – which chimes with the very high rating accorded to ‘follow me’ functionality in list of favoured UX features. Over three in five respondents saw this application of individual profiles as very beneficial, with a further 28% seeing it as moderately beneficial.

Also rated very highly was the role individual profiles play in

Fig. 2 Which of the following elements will be important in creating a compelling TV UX either now or in the future?

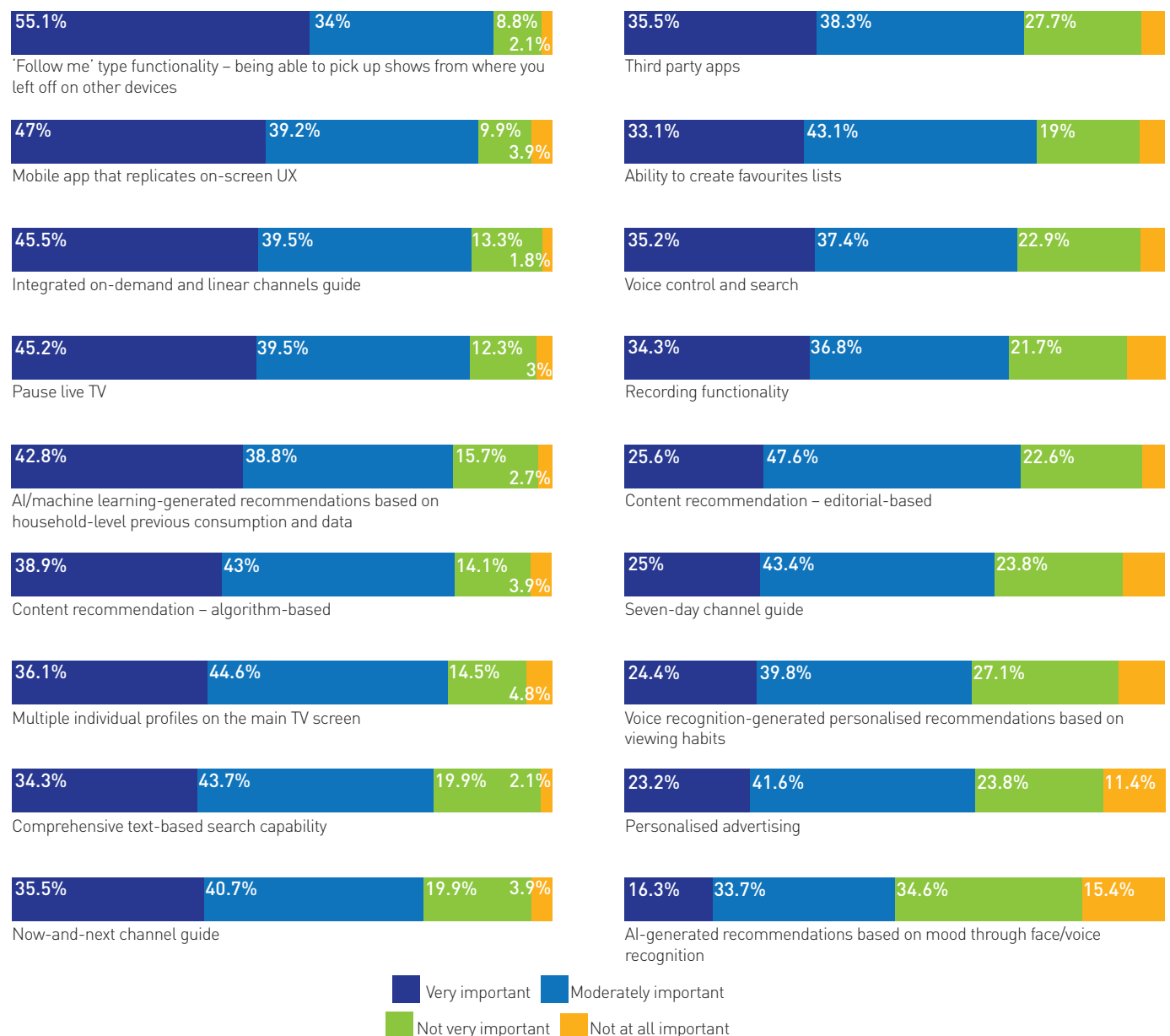
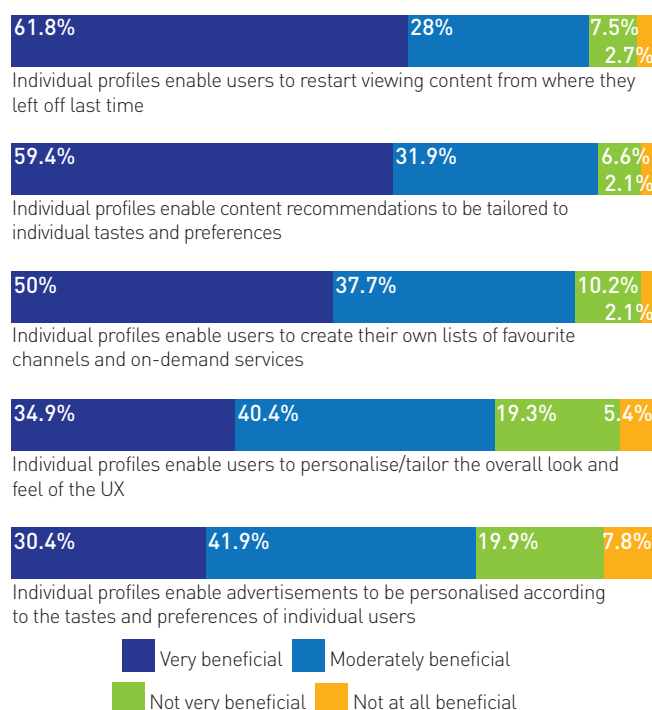


Fig. 3 What are the principal benefits of creating individual profiles on the main TV screen?



enabling content recommendations to be tailored to individual tastes and preferences. This again chimes with the importance accorded to AI or algorithm-based content recommendation in the list of favoured UX features.

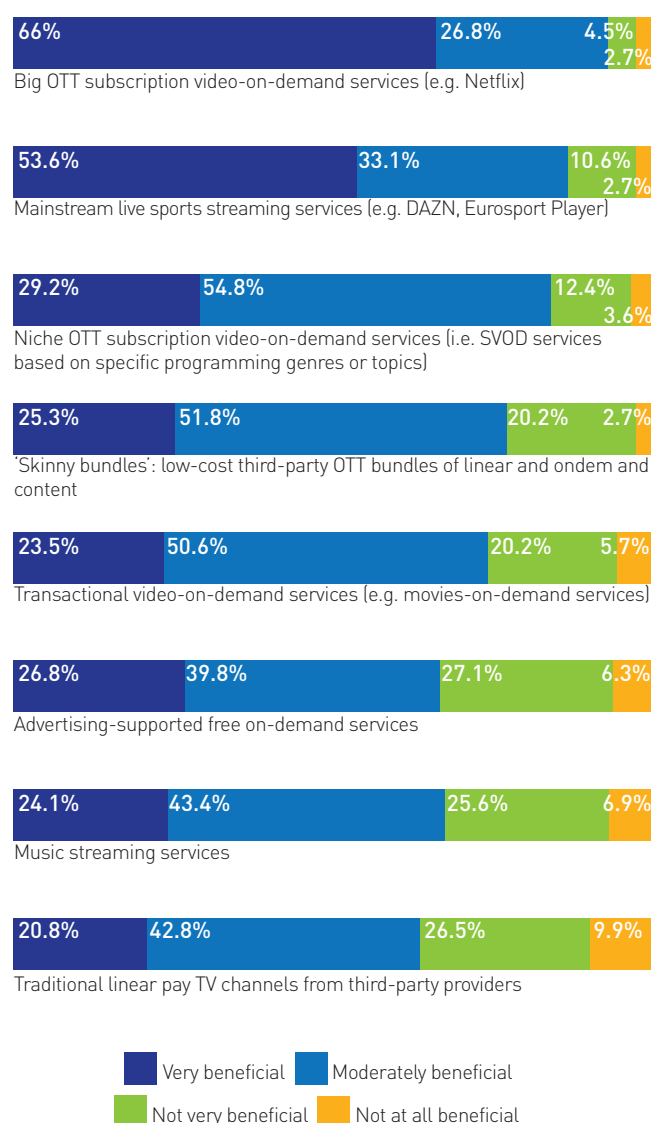
The third most important benefit of profiles, in the view of respondents, was the role they play in enabling users to create lists of favourite channels and on-demand services.

Of somewhat lesser importance, relatively speaking, are the use of profiles to enable users to tailor the overall look and feel of their UX, and – taking up the rear, in line with the lack of enthusiasm among our respondents for personalised advertising – the use of profiles to enable ads to be targeted according to the tastes and preference of individual users. (fig. 3)

We also asked respondents to rate the benefits to service providers of integrating third-party content and apps within their UX. In this case, the integration of big OTT SVOD services such as Netflix takes top place. Two thirds of respondents see this as very beneficial with a further 27% seeing it as moderately beneficial.

The other type of content app that is seen as highly beneficial by a majority of respondents is mainstream live sports streaming services such as Eurosport Player or DAZN. Some 54% see this as very beneficial, with a further third of respondents seeing it as moderately beneficial.

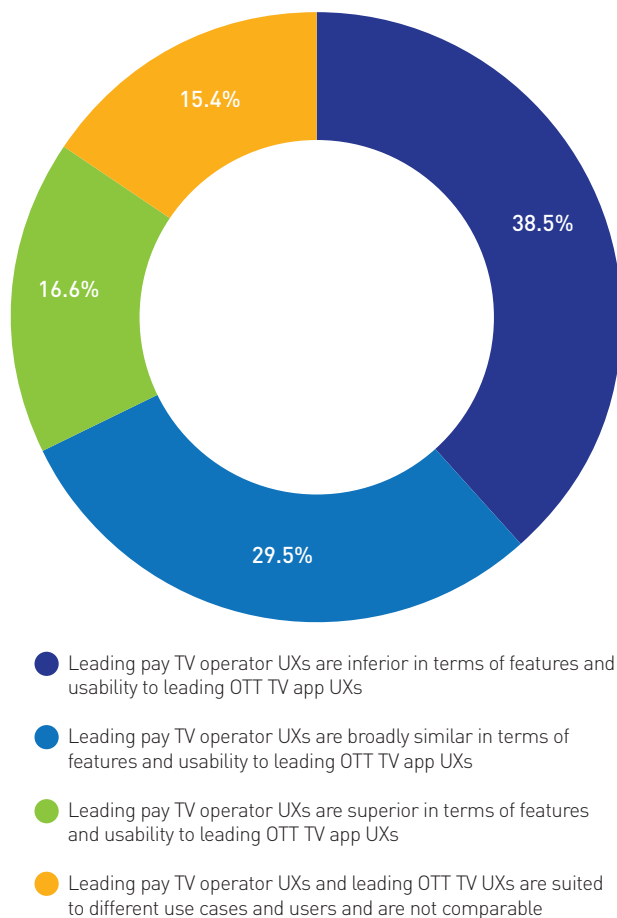
Fig. 4 How beneficial is it for service providers to integrate the following types of third-party content/services within their UX?



Other apps that are seen as beneficial include niche OTT SVOD services such as those build around specific programming genres or topics. These are seen as very beneficial by 29% of respondents and moderately beneficial by 55%. Skinny bundle-type services – combining linear offerings with on-demand content – are also viewed favourably, with over half of respondents believing they are moderately beneficial. The same is true of transactional video-on-demand services, including movies-on-demand offerings.

Trailing behind in terms of their perceived benefit are advertising-supported free video-on-demand services and music streaming services. (fig. 4)

Fig. 5 Which of the following statements best expresses your view of the relative merits of the current generation of pay TV operator UX and the UX provided by leading OTT TV players?



Building the UX

While survey respondents see clear benefits to including big-name third-party OTT TV apps as part of the UX, it is worth remembering that these services have their own UX, and users may find these more compelling than the pay TV service that sits on top.

We also asked respondents to express a view about the relative merits of the current generation of pay TV operator UX and the UX provided by leading OTT TV operators. The results were instructive. Some 39% of respondents believe that leading pay TV operator UXs are inferior in terms of features and usability to leading OTT TV equivalents, compared with only 17% who believe that leading pay TV UXs are superior. (Some 30% believe that pay TV and OTT TV app UXs are broadly similar in terms of features and usability, while 15% believe the two are suited to different use cases and are not comparable.) (fig. 5)

The threat that OTT TV players could outflank leading pay TV

operator in an area where the latter are increasingly trying to differentiate their offerings is one to be taken seriously. But pay TV operators face a set of challenges in developing a compelling UX that may not necessarily apply to OTT TV providers.

We asked our survey sample to rate various challenges that could stand in the way of TV operators delivering a best-in-class UX. The top-rated challenge was that TV operators have to cater to a broad range of viewers with different expectations, knowledge, preferences, skills and tolerance to change, something that does not necessarily affect OTT TV providers. Over half of respondents believe this is a very significant challenge for pay TV providers, with a further 38% viewing it as moderately significant.

Respondents equally believe that operators face a serious challenge in addressing legacy set-top boxes, another factor that does not come into play for OTT TV providers. Some 49% of respondents view this as a very significant challenge, with a further 39% viewing it as a moderately significant challenge.

Respondents are less convinced – relatively speaking – that the growing super-aggregator role of pay TV providers stands in the way of them providing a compelling UX. Some 34% believe that the need to accommodate the individual UXs of multiple content partners that wish to retain control of the way their content is presented to users is a very significant challenge, although half of respondents view it as a moderately significant challenge.

Our survey sample was sympathetic to the view that TV operators lack the scale and resources available to global tech giants in creating a compelling UX, although this is seen as relatively less important than the other factors considered. Some 31% believe this is a very significant challenge, while 40% believe it is moderately significant. (fig. 6)

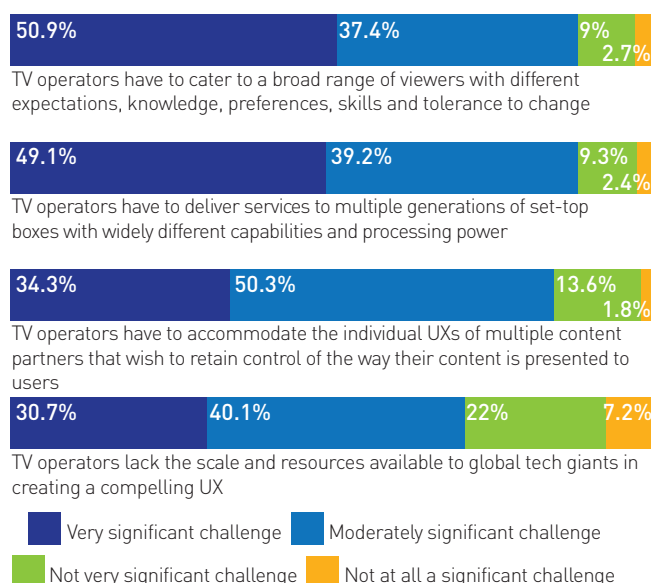
One potential solution to the challenges of developing a world-class UX that can compete with that of larger players is to outsource all or part of the process to a trusted partner. We asked survey respondents to take a view on whether it makes sense for TV operators to create their own bespoke UX or rely on a single technology partner to provide the UX for them.

Some 40% of respondents endorsed the view that it makes sense for TV operators to rely on a trusted technology partner to create a UX for them based on a standard platform but tailored to their own unique requirements, as this enables them to benefit from the scale and innovation of standard technology while creating a UX tailored to their requirements.

A smaller group of 8% go further and endorse the view that operators should rely on a trusted technology partner to provide a standard off-the-shelf UX, as this enables them to benefit from the scale and innovation of standard technology and to get a service up and running extremely quickly.

This compares with 32% who believe that it makes sense for TV operators to build a UX in partnership with a trusted proprietary technology partner as this enables them to create a unique offering while benefiting from the scale and expertise of a specialist provider. A smaller group of around 20% believe that TV operator should create their own bespoke UX as this gives them greater control and the ability to differentiate their offering. (fig. 7)

Fig. 6 For TV operators, how important are the following challenges that stand in the way of delivering a best-in-class UX?



Conclusion

The UX plays a highly important role in enabling service providers to differentiate their propositions, at least the equal of the content line-up among the factors.

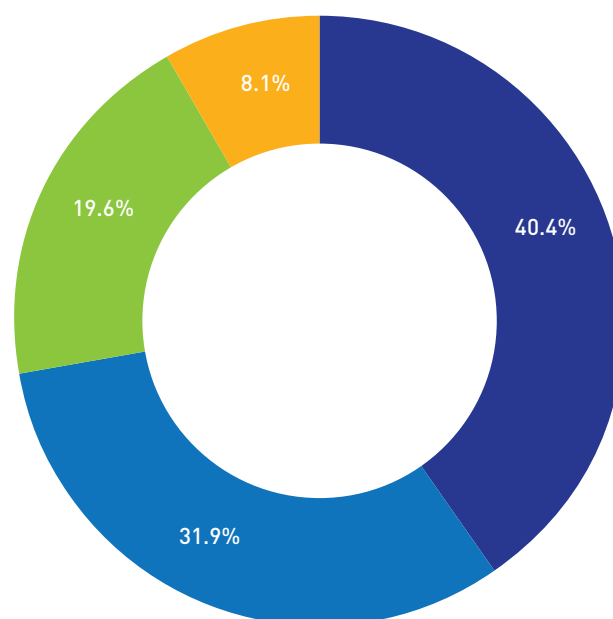
In the view of our survey respondents, the most important features of the modern UX are those that enable a seamless multiscreen experience, including the ability to pick up shows from where viewers' left off from one device to another and having a mobile app that replicates the onscreen TV UX.

Respondents see individual profiles as part of the TV UX primarily as important enablers of that seamless multiscreen experience. Profiles are also important in enabling content recommendations to be tailored to individual tastes and preferences, in the view of our survey sample.

Regarding another key feature of the modern TV UX – access to OTT TV apps – survey respondents see the main benefit being to provide access to big ticket OTT providers such as Netflix, along with high-profile sports streaming services such as Eurosport or DAZN. Access to niche SVOD services is also seen as beneficial.

TV operators that provide access to highly-regarded third-party apps such as Netflix need to be confident about the usability and attractiveness of their own user experience, despite facing challenges that streaming providers do not face, such as catering to a very broad range of consumers with different expectations and providing services to legacy set-top boxes.

Fig. 7 Which of the following statements best expresses your view of whether it makes sense for TV operators to create their own bespoke UX or rely on a single technology partner to provide the UX for them?



- It makes sense for TV operators to rely on a trusted technology partner to create a UX for them based on a standard platform but tailored to their own unique requirements, as this enables them to benefit from the scale the scale and innovation of standard technology while creating a UX tailored to their requirements
- It makes sense for TV operators to build a UX in partnership with a trusted proprietary technology partner as this enables them to create a unique offering while benefiting from the scale and expertise of a specialist provider
- It makes sense for TV operators to create their own bespoke UX as this gives them greater control and the ability to differentiate their offering
- Leading pay TV operator UXs and leading OTT TV UXs are suited to different use cases and users and are not comparable

In the view of survey respondents, the best way to meet the challenge of developing a compelling UX is to rely on a trusted technology partner to create a UX for them, with a preference for a UX that is tailored to their own specific requirements. ●

The future of the set-top box

Introduction

Questions about whether that the set-top box as a device is destined for terminal decline in popularity are widespread, fuelled by the growing prominence of app-based delivery of content to multiple screens and the apparent decline of traditional pay TV in general.

With pay TV operators facing unprecedented competition from OTT TV providers as well as changing consumption patterns, the popularity of solutions such as the Android TV Operator Tier attests to an urgent need to open up platforms to third-party streaming services as well as to maintain the flexibility to get new services up and running at 'web speed'.

In the longer term, the question is open as to whether operators will continue to invest in consumer premises equipment or adopt a 'bring-your-own-device' strategy, with a TV-as-an-app model. While this removes a major cost, it also presents significant challenges to their ability to differentiate their offerings.



We're always innovating to create the ultimate entertainment experience. We touch the lives of binge-watching, music-loving, entertainment fanatics every day by delivering beautiful user experiences and enabling the world's leading media and entertainment providers to nurture more meaningful relationships with their audiences.

Our technology inventions run deep – from the creation of the interactive program guide to the DVR – and we continue to revolutionize how people find content in a chaotic, fragmented media

landscape. It's this "content chaos" and insatiable demand for media and entertainment that keep us inspired – to create products and licensable technology that ultimately enable people to find and enjoy the TV, movies and music they love.

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The future of the set-top box

Perceived decline of the set-top box market

Our survey respondents take the view that the set-top box market will decline or even disappear over the next 10 years. Specifically, 47% are of the opinion that it will decline while 17% believe it will disappear completely.

Of the remainder, 23% believe the market will level off over the next decade. Only a small minority – under 14% – think it will continue to grow. (fig. 1)

In this context, respondents understandably are also of the view that pay TV operators will increasingly look at alternative means of distributing content to end users. Fewer than 20% of respondents believe that set-top boxes will remain a key tool for most pay TV providers, something of a reversal of fortune for a category of device that has been the mainstay of the pay TV industry since its inception.

Of respondents that didn't agree, almost half endorse the view that

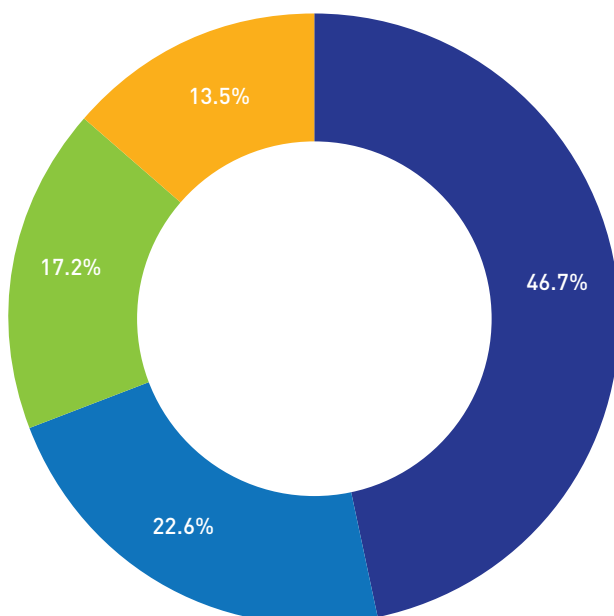
set-top boxes will remain a key tool but only for a limited number of pay TV providers, while almost a third – over 31% – think that set-tops will cease to be of importance for pay TV operators entirely. (fig. 2)

In an evolving TV landscape of multiscreen and app-based viewing, it is conceivable that TV operators will look for ready-made solutions that require lower allocations of internal resources to integrate and deploy. The urgent need for standard solutions that can be deployed with minimum integration effort but which still allow operators a certain amount of freedom to differentiate their offerings has led to the rapid growth in the Android TV Operator Tier platform and provides the rationale behind the cable industry's RDK initiative.

We asked respondents to rate five types of set-top platform for the benefit they bring to service providers: standard Android TV, Android TV Operator Tier; Android Open Source Project; RDK; and high-quality proprietary set-top box platform considered as a single category.

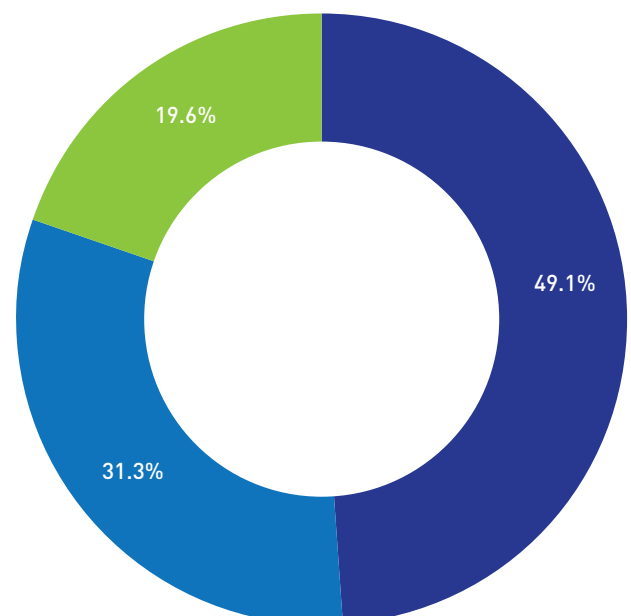
While none of the platforms considered elicited overwhelming support, the clear winner in popularity among our survey sample was

Fig. 1 Which of the following statements best expresses your opinion about the future of the set-top box market over the next 10 years?



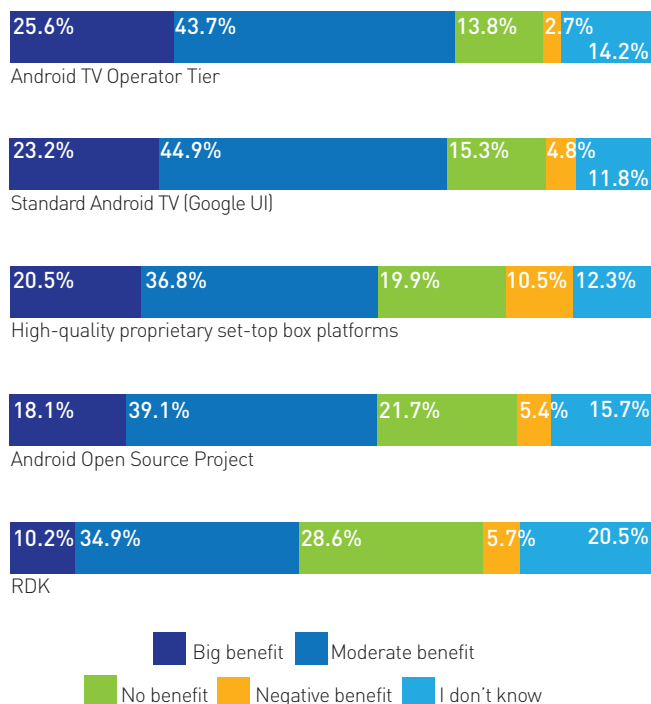
- The set-top box market will decline
- The set-top box market will plateau
- The set-top box market will disappear completely
- The set-top box market will continue to grow

Fig. 2 How important will operator-managed set-top boxes be to pay TV operators over the next 10 years?



- Set-top boxes will remain a key tool but only for a limited number of pay TV providers
- Set-top boxes will cease to be of importance for pay TV providers
- Set-top boxes will remain a key tool for most pay TV providers

Fig. 3 How big a benefit do the following set-top platforms bring to service providers?



the Android TV Operator Tier. Awareness of this platform was relatively high, with only 14% declining to respond on the grounds of lack of knowledge of it. Some 26% of respondents thought that this platform would provide a big benefit for operators, while a further 44% thought that it would provide a moderate benefit.

Following closely behind in the popularity stakes among the platforms considered was standard Android TV (Google UI), which had the highest level of awareness (fewer than 12% professed ignorance), with 23% believing it provides a big benefit and 45% believing it provides a moderate benefit.

High-quality proprietary platforms come next in the order of preferred platforms, followed by Android Open Source Project, with a notable rise in lack of knowledge relating to the latter. (Android Open Source Project was an initiative whereby Google made most – but not all – of the elements of the Android source code available royalty-free to third parties to develop their own proprietary devices and services.)

Cable-centric RDK attracted the fewest supporters of the five options on offer and elicited the highest level of lack of awareness of the five, with over 20% confessing lack of knowledge.

Only 10% of respondents believed that RDK would provide a big benefit to operators, outnumbered by the 29% who believed it would provide no benefit. Some 6% believed RDK would have a negative impact. (fig. 3)

Android TV Operator Tier

Taking a deeper dive into perceptions about Android TV Operator Tier, we asked respondents how well they thought this platform performed relative to alternatives across a range of criteria.

The platform performed reasonably well across all seven criteria, in the view of respondents who expressed a view. It was most highly rated for access to content – meaning the ability of service providers to use the platform to bring content from multiple sources to their customers. Some 24% of respondents rated it as excellent, while 42% rated it good.

The Android TV Operator Tier was also highly rated for enabling operators to get services up and running quickly, where 22% rated it excellent and 39% rated it good, and for ease of use, where 21% rated in excellent and 40% rated it good.

It achieved a respectable score for ease of use and for its potential for customisation – allowing service providers to tailor the platform to match their requirements, reinforcing the view that Google has largely succeeded in alleviating concerns that operators would be unable to differentiate their offerings if they teamed up with the software giant.

Android TV Operator Tier also achieved moderately positive scores for ease of deployment, enabling operators to avoid costly integrations, and for cost-effectiveness, enabling them to avoid huge upfront investments.

The one area where doubts appear to mount in relation to Android TV Operator Tier is security, with a significant minority of respondents expressing concerns that the ability of service providers to secure content and revenues on the platform could be compromised. Some 27% of respondents rated the platform as either poor or very poor for enabling service providers to secure content and revenues effectively. (fig. 4)

The key benefit of the Android TV Operator Tier, in the view of respondents, is that it provides easy access to multiple services.

We asked our survey sample to express a view on the advantages or disadvantages to operators of opening their set-top box platform up to the range of apps available from the Google Play Store.

Over half of respondents viewed this as broadly positive. Some 52% endorsed the view that it brings some benefits with increased range of content to subscribers, with only the minor drawback of loss of control of platforms. Some 18% were more strongly positive, taking the view that Google Play Store brings huge benefits with increased range of content to subscribers, with limited drawbacks.

Among those respondents who took a more critical view, some 23% believe that opening up the platform to the Google Play store brings limited benefits of increased range of content to subscribers, with the significant drawback of loss of control of platforms, while 7% said that the drawbacks far outweigh any benefits. (fig. 5)

The BYOD world

While the Android TV Operator Tier platform has captured much industry attention over the last 18 months, in the longer term the perceived decline of the set-top box predicted by respondents would indicate an expectation that there will be a rapid growth in operators adopting a bring-your-own-device (BYOD) strategy.



Amplify the value of Android TV with TiVo



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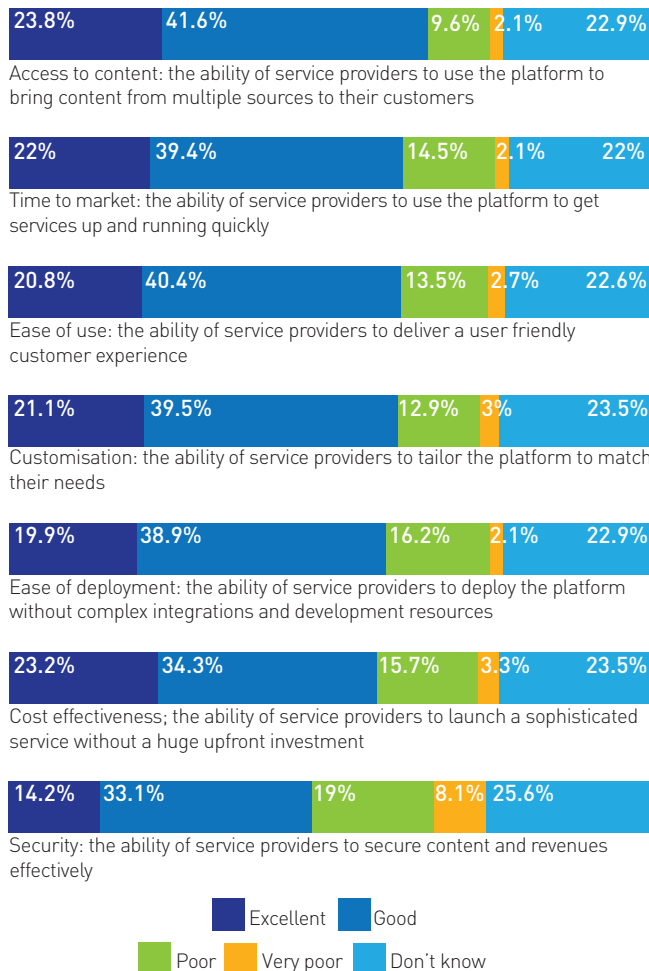
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Fig. 4 How well do you think the Android TV Operator Tier performs relative to alternative platforms?



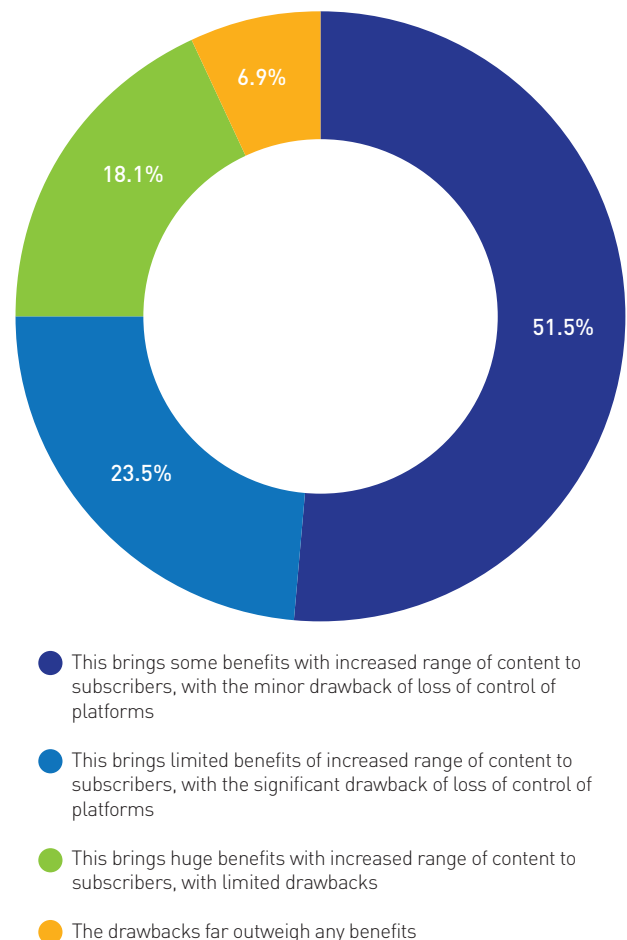
We asked our survey sample to take a view on whether BYOD provides benefits or drawbacks to operators, compared with investing in proprietary consumer premises equipment.

Over half of respondents believe that the benefits of BYOD outweigh the drawbacks, with 32% believing that the benefits slightly outweigh the drawbacks and 20% believing that benefits greatly outweigh drawbacks.

Of the remainder, a further 22% of respondents believe that the benefits and drawbacks of BYOD are roughly equal. Only a minority take a negative view, and even here, the bulk of respondents hedge their opinion with a caveat. Some 19% endorse the view that drawbacks slightly outweigh benefits. Only a small minority – 7% – believe that the drawbacks of BYOD greatly outweigh the benefits. (fig. 6)

Diving deeper, we asked respondents to rate the supposed advantages of adopting a BYOD strategy. The biggest benefit, in the view of our survey sample, is that operators no longer need to invest in and depreciate set-top boxes on their balance sheet. Over half of

Fig. 5 Which of the following statements best expresses your opinion about the advantages or disadvantages to operators of opening their set-top box platform up to the range of apps available from the Google Play Store?



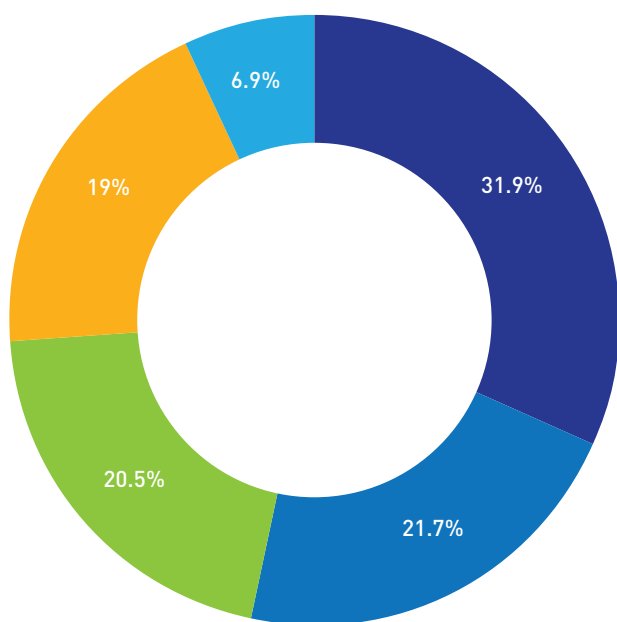
respondents thought this was a big advantage, while a further two in five thought it was a moderate advantage.

The second most highly-rated advantage of going BYOD, in the view of respondents, is that operators are better placed to take advantage of innovation in consumer hardware to deliver more advanced services and a better user experience. Some 38% see this as a big advantage and a further 43% see it as a moderate advantage.

Close behind in terms of its overall rating among respondents is that BYOD generally gives subscribers easy access to a wide range of third-party OTT TV apps. Some 40% see this as a big advantage and 38% see it as a moderate advantage.

It has been suggested that adopting a BYOD strategy would mean that subscribers would be less likely to rely on operators' call centres and blame them when things go wrong. However, only 24% of our survey respondents saw this as a big advantage, while 27% saw it as conferring no advantage at all and 14% actually saw it as a disadvantage, possibly

Fig. 6 Do you think a 'bring your own device' (BYOD) strategy brings more benefits or drawbacks to operators, as compared to investing in consumer premises equipment?



- Benefits to BYOD slightly outweigh the drawbacks
- Benefits and drawbacks of BYOD are equal
- Benefits to BYOD greatly outweigh the drawbacks
- Drawbacks to BYOD slightly outweigh the benefits
- Drawbacks to BYOD greatly outweigh the benefits

because it breaks the relationship that operators have with customers through their call centres. (fig. 7)

Finally, we asked respondents to consider the main challenges operators face when adopting a BYOD strategy. Interestingly, while respondents were overwhelmingly positive about BYOD in principle, they saw major challenges in the way of realising the BYOD vision.

The biggest challenge, in the view of our survey sample, is that operators have no way of ensuring their own services are given prominence in a BYOD world. Some 47% saw this as a very big challenge and a further 46% saw it as a moderate challenge. Only one single respondent did not believe that this presented no challenge at all to operators.

Respondents were also concerned that operators have no way of guaranteeing the Quality of Service that consumers of premium services expect in a BYOD world. Some 39% of respondents saw this as a very big challenge, while a slightly higher proportion saw it as a moderate challenge.

Our survey respondents were also concerned that BYOD means that operators no longer have control of the user experience. Some 37% saw this as a very big challenge and 45% saw it as a moderate challenge.

Our sample was less worried about the impact of BYOD on the presence of their brand in the mind of the consumer, something that is often cited

Fig. 7 What are the major advantages to operators of adopting a BYOD strategy to deliver content to subscribers?

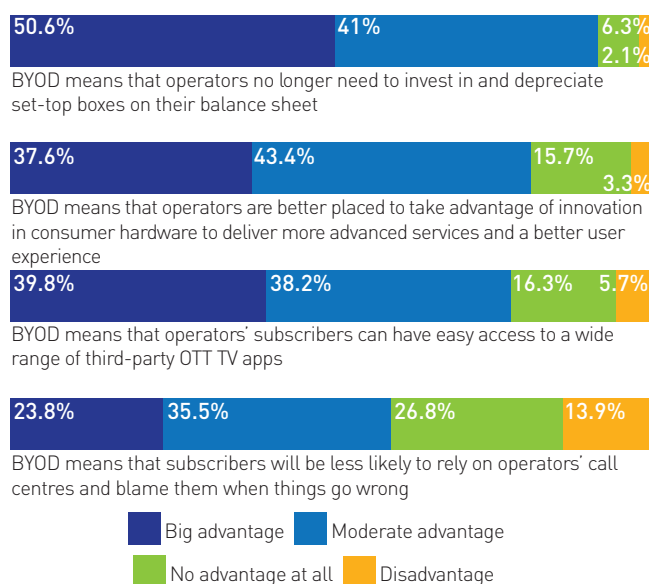


Fig. 8 What major challenges do you associate with using a BYOD strategy to reach customers?



as a reason why operators will continue to invest in their own consumer premises equipment. Only a third of respondents saw this as a very big challenge, while a quarter saw it as either not a very big challenge or no challenge at all. (fig. 8)

Conclusion

In the collective view of respondents to this survey, the perception is that the set-top box market is set to decline over the next decade and pay TV operators will increasingly look to other means to distribute content to end users.

In the interim, our survey shows that operators appear to be increasingly looking for ready-made solutions rather than investing in proprietary hardware. Of the principal choices facing operators today, our survey respondents rated the Android TV Operator Tier platform as conferring the greatest benefit for service providers. Other platforms considered include other variants of Android TV, the cable-centric RDK platform and proprietary platforms.

The biggest single advantage of Android TV, in the view of respondents, is that it provides maximum access to content thanks to the Google Play store. Android TV Operator Tier is also rated highly for enabling operators to get services off the ground quickly.

Bring-your-own-device provides an alternative way for operators to reach customers. Survey respondents were overwhelmingly positive about the benefits of BYOD in theory, noting in particular that it means operators will no longer have to invest in and depreciate set-top boxes on their balance sheet, and that it will enable them to take advantage of innovation in consumer hardware to deliver a superior user experience.

However, BYOD also comes with challenges, and survey respondents, when prompted, endorsed the view that these challenges are considerable. In particular the view that operators have no means to ensure their own services are given prominence in a BYOD world struck a chord. ●

HbbTV

Introduction

HbbTV – Hybrid Broadcast Broadband TV – has been designed as a standardised way of maintaining the relevance of broadcast platforms in an age when more and more content consumption is of online services.

HbbTV enables rich content to be delivered over broadband connections to complement broadcast services, and also enables OTT TV services to be provided via a broadcast TV interface to TV screens. Much of the commercial potential of the technology remains to be tapped however, and this includes the potential use of HbbTV to measure digital audiences and to facilitate the delivery of targeted addressable advertising.

More recently, HbbTV has been adapted – via the HbbTV Operator Application Specification – to function as a virtual set-top box and allow TV operators to provide services to connected TVs without the need to purchase and deploy consumer premises hardware.



Vewd is the world's largest independent OTT software provider. We enable our customers and partners to reliably, seamlessly and efficiently reach viewers on over 275 million connected TV devices around the world. Market leading TV OEMs, Operators and Content Owners like Samsung, Sony, Verizon, Swisscom and the BBC trust us to deliver the best linear, hybrid and OTT products and solutions.

With over 17 years experience in the TV software industry, we boast

technological expertise that continuously satisfies the ever-evolving demand for flexible, scalable and adaptable software solutions.

Our experience developing software solutions spanning client to cloud provides customers and partners the products they need to connect consumers with the content they love.

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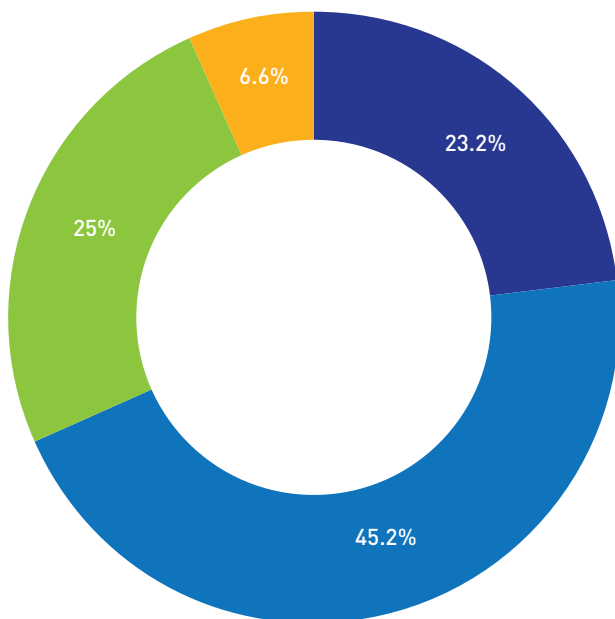
HbbTV

HbbTV progress

HbbTV is a technology that has been around for a number of years now, and the majority of our survey respondents have a positive view of it. Some 68% of respondents noted that HbbTV is a very attractive (23%) or moderately attractive (45%) technology for the delivery of advanced TV services and consumers are satisfied with it.

Only a relatively small minority of respondents have a more mixed view. One in four take the view that HbbTV is not a very attractive technology and that consumers are not particularly satisfied. Just under 7% took that view that consumers are positively dissatisfied with HbbTV. (fig. 1)

Fig. 1 Which of the following statements best expresses your view of how attractive HbbTV is as a technology to deliver advanced TV services and how well received it is by consumers?



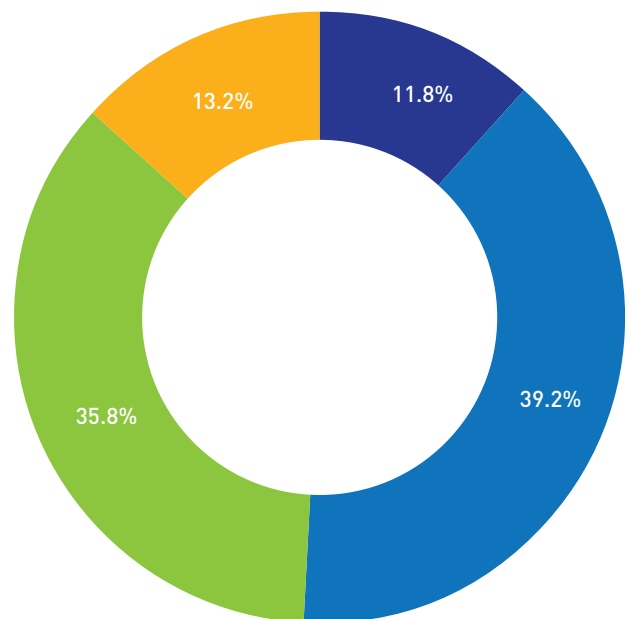
- HbbTV is a very attractive technology for the delivery of advanced TV services and consumers are highly satisfied with it
- HbbTV is a moderately attractive technology for the delivery of advanced TV services and consumers are satisfied with it
- HbbTV is not a very attractive technology for the delivery of advanced TV services and consumers are not particularly satisfied with it
- HbbTV is not an attractive technology for the delivery of advanced TV services and consumers are dissatisfied with it

The majority of respondents with awareness of the market also believe that HbbTV has made good progress technologically. Close to three in five respondents with awareness of the market believe that the deployment of HbbTV is very well advanced or moderately well advanced in line with expectations.

However, 36% of respondents believe that HbbTV service deployment is not very well advanced and that deployment is behind expectations. About 13% of all respondents say they do not know how well deployed the technology is. (The technology is currently available in 35 countries, with about 200 applications and 44 million devices deployed since 2011 – information that was shared with survey respondents.) (fig. 2)

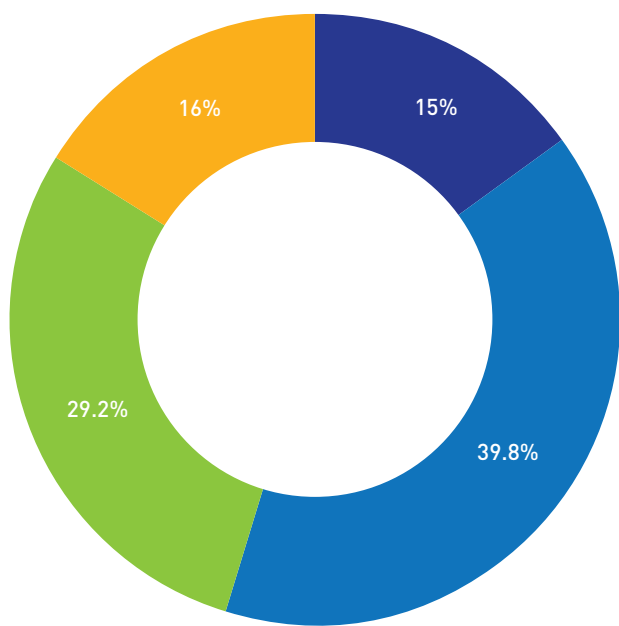
On the question of the readiness of the technology compared with

Fig. 2 How would you describe the commercial deployment progress to date of HbbTV services (which are currently available in 35 countries, with around 200 applications and 44 million devices deployed since 2011)?



- Deployment of HbbTV services is very advanced/ahead of expectations
- Deployment of HbbTV services is moderately well advanced/in line with expectations
- Deployment of HbbTV services is not very well advanced/behind expectations
- I don't know how well deployed HbbTV services are

Fig. 3 Which of the following statements best expresses your view of how well matched HbbTV technology is with the commercial imperative to launch services?



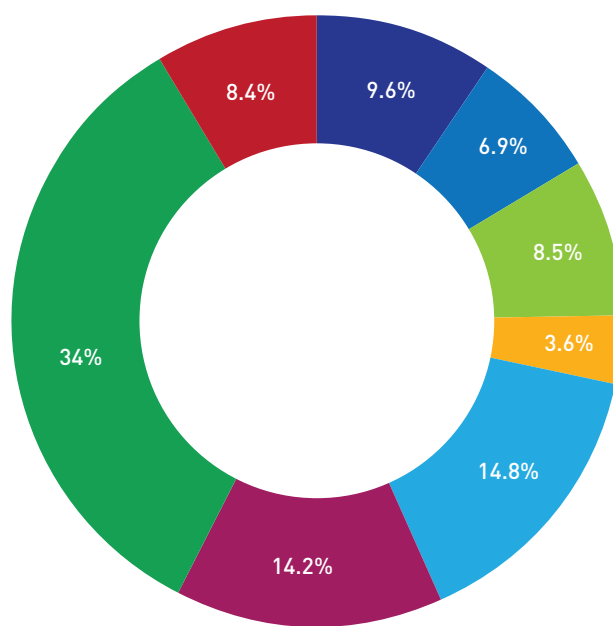
- HbbTV technology development is well ahead of the preparedness of broadcasters and operators to launch services
- HbbTV technology development matches the preparedness of broadcasters and operators to launch services
- HbbTV technology development is falling behind the preparedness of broadcasters and operators to launch services
- Broadcasters and operators are insufficiently aware of the benefits of HbbTV technology to launch services

the readiness of broadcasters and TV operators to launch commercial services, 15% of respondents believe that HbbTV technology development is well ahead of the preparedness of broadcasters and operators, while 40% are of the view that the state of readiness of the technology and the preparedness of broadcasters more or less match up. However, 29% think that HbbTV technology is falling behind the preparedness of broadcasters and operators to launch services, while 16% believe that broadcasters are not sufficiently aware of the benefits of HbbTV to launch services. (fig. 3)

Among survey respondents themselves, approximately three out of five said that HbbTV was relevant to their business in some way, with just over a third saying it was not relevant and 8% admitting to not knowing if their company had launched HbbTV services or not.

Some 10% of respondents said their organisation had full deployed commercial HbbTV services, while a further 7% said they were at an advanced stage in the deployment of HbbTV services but have yet to

Fig. 4 Which of the following statements best defines your company/organisation's involvement with HbbTV technology?



- We have fully deployed commercial HbbTV services
- We are at an advanced stage in the deployment of HbbTV services but we have yet to fully commercialise them
- We are at a trial stage in the deployment of HbbTV services
- We are planning to deploy HbbTV services in the near future
- We are evaluating HbbTV technology but do not yet have a definite plan to deploy services
- We have no plans to deploy HbbTV services although it theoretically could be an option for us
- HbbTV technology is not relevant to our business
- I don't know if we have deployed HbbTV services or not

fully commercialise them. Some 8% are at a trial stage in the deployment of HbbTV services and a further 4% say they are planning to deploy services in the near future.

That leaves 30% of respondents who think HbbTV is relevant, but only 15% are looking into it. So 15% of respondents represent companies for whom HbbTV is relevant, but they aren't thinking about it even though a majority of respondents think HbbTV is valuable. (fig. 4)

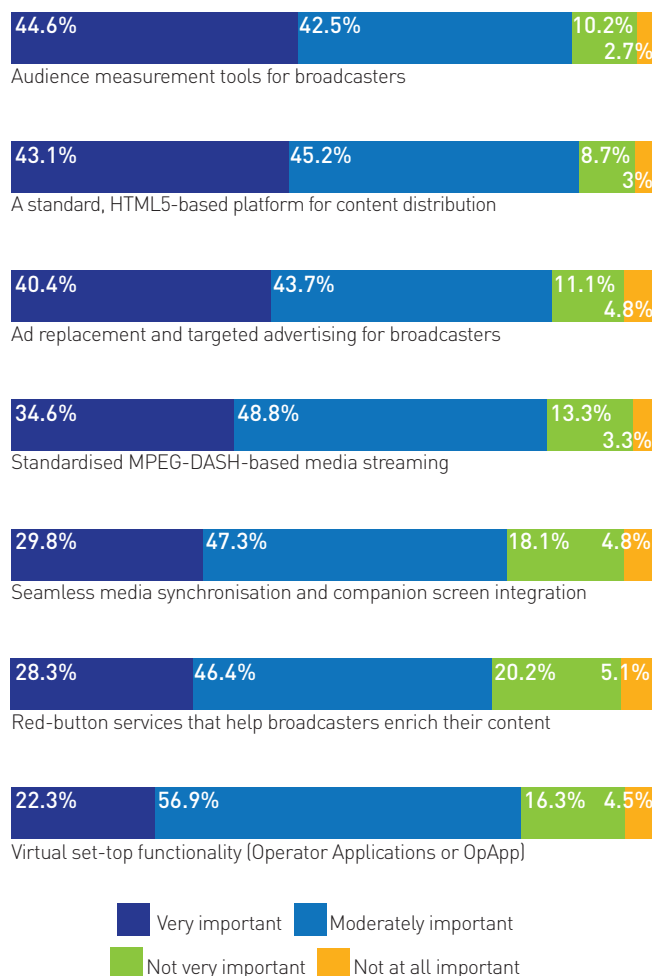
Features and functionality

We asked respondents to rate a set of seven HbbTV features and functionalities for their perceived usefulness and took a deeper dive into two applications in particular – HbbTV targeted advertising and the new HbbTV OpApp. Industry perspectives on the latter will be considered separately in the following section.

Our survey sample was overwhelmingly positive about the usefulness of all the applications considered to broadcasters and TV operators, with a clear majority endorsing the view that they are, without exception, either very important or moderately important.

The use of the technology as an audience measurement tool for broadcasters is very highly rated by 45% of respondents and viewed as moderately important by 42%. In an age when a growing portion of TV viewing is time-shifted and when a growing portion of TV services

Fig. 5 Which of the following HbbTV features and functionalities do you believe has a high value for broadcasters and operators?



are delivered online, it is clear that accurate audience measurement of this increasingly fragmented viewing universe will become more important to commercial broadcasters.

HbbTV is also highly rated for providing a standard HTML-5-based platform for content distribution, with 43% seeing this as very important and 45% seeing it as moderately important.

In line with the view that audience ratings are important, some 40% of respondents also believe advertising replacement and targeting functionality is very important and 44% rate it as moderately important.

Some 35% of respondents rate HbbTV's ability to deliver a standardised MPEG-DASH-based media streaming platform as very important, while 49% believe this is moderately important.

Also very relevant, in the view of our survey sample, is the ability of HbbTV to support seamless media synchronisation. Some 30% believe this to be very important and 47% think it is moderately important.

The ability of HbbTV to support red-button services that enrich their content is also rated highly, but with a minority dissenting. Some 75% believe it is very important or moderately important, while a minority of one in four respondents are of the view that it is either not very important or not at all important.

Finally the new HbbTV OpApp specification, which provides virtual set-top box functionality, is already viewed as very important or moderately important by four out of five respondents. This specification will be looked at in more detail below. (fig. 5)

We took a deeper dive into one of the most highly-rated HbbTV-enabled functionalities – targeted advertising – to verify how relevant this application was to survey respondents. Just over two thirds of respondents said that targeted advertising for broadcast services was relevant for their business. Some 13% of our survey sample say they have deployed targeted advertising for broadcast services, while 9% are at the stage of trialling the delivery of targeted advertising. A further 9% say they are planning to deploy targeted advertising for broadcast services in the near future.

A larger group – 20% of all respondents – say they are evaluating the deployment of targeted advertising for broadcast services but do not have a definite plan to launch while just over 16% say they have no plans to deploy targeted advertising for broadcast services, although this could in theory be relevant for their business. (fig. 6)

HbbTV OpApp

Finally, we assessed views of the likely impact of the HbbTV OpApp specification in more detail. This specification, which builds on HbbTV version 2, is designed to enable operators, in partnership with TV manufacturers, to provide an operator-branded TV experience as an app on internet-connected TVs – in other words to create a 'virtual set-top box' to enable TV operators to deploy services without the need to invest in proprietary consumer premises equipment.

As shown in fig. 6, while 79.2% of respondents believe HbbTV OpApp is either very or moderately important, 30% don't even know what it is. This indicates the need for a stronger educational push given the perceived value respondents place on the technology.



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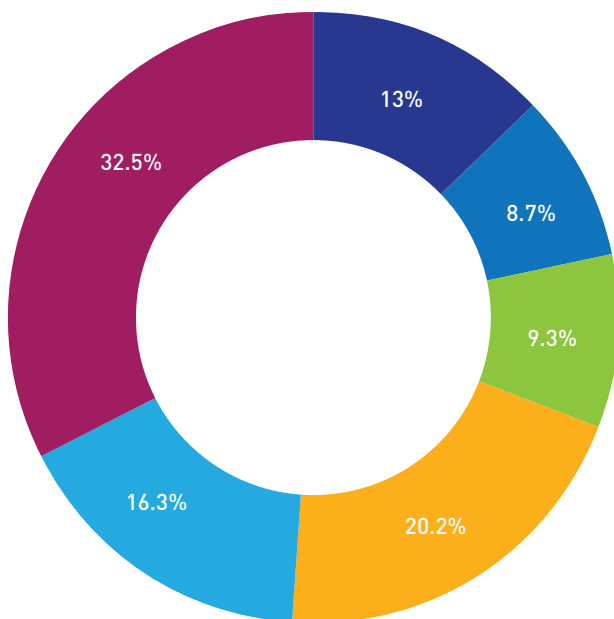


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Fig. 6 Which of the following statements best defines your company/organisation's involvement in deploying targeted advertising for broadcast TV services, replacing broadcast ads with ads streamed over broadband?



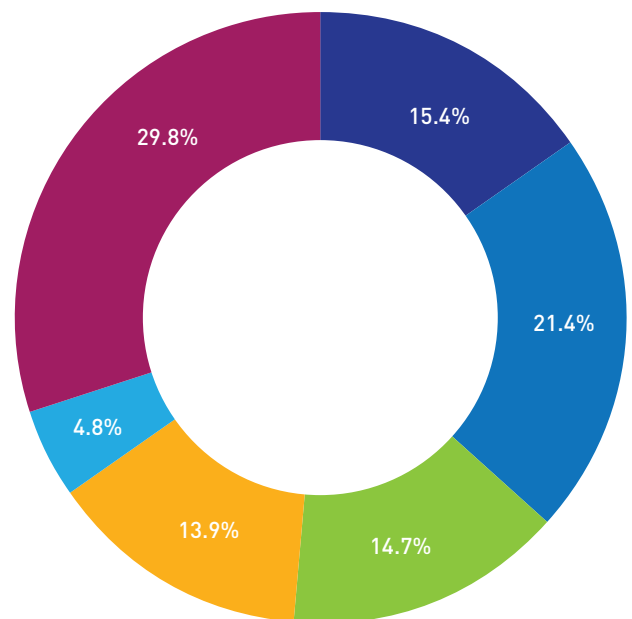
- We have deployed targeted advertising for broadcast services
- We are trialling the delivery of targeted advertising for broadcast services
- We are planning to deploy targeted advertising for broadcast services in the near future
- We are evaluating the deployment of targeted advertising for broadcast services but do not have a definite plan to launch
- We have no plans to deploy targeted advertising for broadcast services, although this could in theory be relevant for our business
- The deployment of targeted advertising for broadcast services is not relevant for our business

Overall, 15% of all respondents believe that the functionality will have a huge impact on TV operators' business in the near term, as it will open up opportunities for service providers and give them flexibility to launch new TV services with less investment. A larger group – 21% of all respondents – take the view that OpApp will have a modest impact on TV operators' business in the near term.

Some 15% endorse the view that OpApp will have a huge impact on TV operators, but that impact will not be significant in the short term, meaning within the next two to three years.

A further 14% of all respondents say they believe OpApp will have no significant impact on TV operators in the short term and only a modest impact in the medium term, while 5% take the view that the technology will not have a significant impact on TV operator' business,

Fig. 7 What is your view of the likely impact of the new HbbTV OpApp specification?



- OpApp will have a huge impact on TV operators' business in the near term – it will open up opportunities for service providers and give them flexibility to launch new TV services with less investment
- OpApp will have a modest impact on TV operators' business in the near term
- OpApp will have a huge impact on TV operators, but that impact will not be significant in the short term (over the next two to three years)
- OpApp will have no significant impact on TV operators in the short term and only a modest impact in the medium term
- OpApp will not have a significant impact on TV operator' business, either in the short term or the medium term
- I don't know what HbbTV OpApp is

either in the short term or the medium term.

Excluding those that are ignorant of the technology, those figures translate into a majority – 52% – believing that OpApp will have either a huge or a more modest impact in the near term, while 44% believe it will have a huge impact either in the near term or in the longer term. This points to a major education gap. Some 30% of respondents don't know OpApp, but a majority of those that are aware of the technology think it will have an impact in the near term (**fig. 7**)

Conclusion

A majority of our survey respondents take the view that HbbTV is an attractive technology for the delivery of advanced TV services, but opinion is much more divided about the state of progress of the technology to date.

While a majority of respondents are of the view that HbbTV deployment is very advanced or moderately well advanced, a significant minority believe that is not well-advanced. While awareness of HbbTV as a technology is high, a minority also admit to not knowing how well-deployed it is.

There is also some uncertainty about how well-matched HbbTV technology is with the readiness of broadcasters and TV operators to launch commercial HbbTV services. A majority of respondents believe either that the technology is more advanced than broadcasters are in their preparedness to use it or that the technology and the preparedness of broadcasters more or less match up. However a significant minority believe the technology deployment is falling behind the commercial readiness of broadcasters to launch services.

In terms of the actual experience of respondents with HbbTV, of those for whom the technology is relevant, just under two in five have deployed some kind of service ranging from full commercial deployment to those at the trial stage.

Respondents value HbbTV primarily for commercial applications and in particular for its ability to deliver accurate audience measurement and the related delivery of targeted advertising, as well as, more generally, its ability to support the delivery of online content to TV screens. Of those for whom targeted advertising is a relevant business case, about a quarter say they have deployed a service and a narrow majority say they have either deployed or are planning to deploy a service.

A significant minority of survey respondents lack awareness of the recent HbbTV OpApp specification – which provides for the use of the technology as a virtual set-top box to enable TV-as-an-app deployments, a fact that may explain why OpApp only registers as a very important feature of HbbTV for a minority of the sample.

However, among those who understand what OpApp is trying to achieve, a majority believe it will have an impact on broadcasters and operators, with over one in five believing it will have a huge impact in the near term. ●

OTT live streaming

Introduction

One of the key questions facing policymakers, broadcasters and service providers as the online video universe expands is whether streaming of linear broadcast channels can ultimately supplant broadcast as the primary means of delivering live and time-sensitive content to users.

The explosion in demand for live streaming of content adds fuel to the debate over the future of broadcast. However, it is not yet clear if and when it will make economic sense to replace broadcast.

Factors behind the growth of live streaming include cord-cutting, taking younger consumers in particular away from pay TV and in search on online alternatives, and the desire to view content on devices other than the traditional TV screen.

Challenges standing in the way of live-streaming conquering all include the need to eliminate the added latency associated with online distribution and the costs of scaling up bandwidth to meet sudden surges in demand associated with major events such as top-tier sports fixtures.



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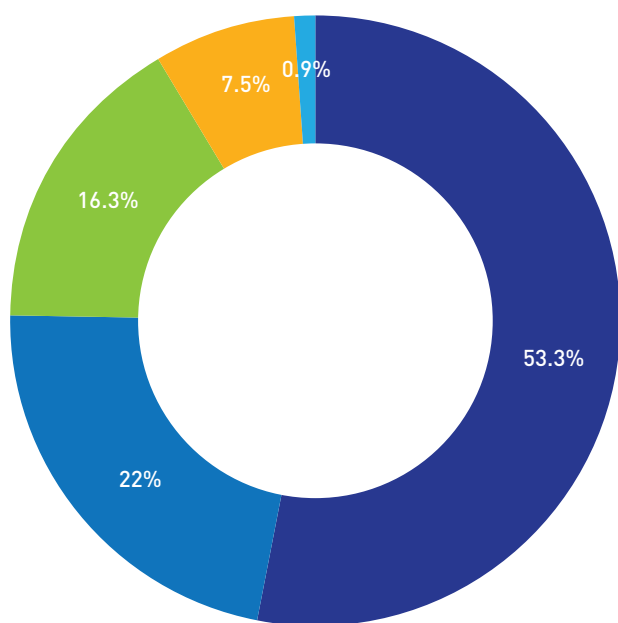
OTT live streaming

Potential and growth factors

Respondents remain to be entirely convinced that OTT live streaming can supplant broadcast, at least in the near term. While a majority believe that OTT TV for live streaming is improving and could ultimately supplant broadcast when the technology is more mature, only 22% think that OTT TV is highly suitable for live streaming today and will soon supplant broadcast.

Nevertheless, a majority of respondents do take the view that OTT TV can supplant broadcast TV in the longer term. Fewer than 1% believe that the technology is inherently unsuitable for live

Fig. 1 Which of the following statements best expresses your opinion about the suitability of OTT TV as a platform for live-streaming of mass audience content?



- OTT TV for live streaming is improving and could ultimately supplant broadcast when the technology is more mature
- OTT TV is highly suitable as a platform for live streaming and will soon supplant broadcast
- OTT TV for live streaming is improving as a platform but is unlikely ever to supplant broadcast
- OTT TV is suitable for live streaming of niche-interest content only and will never supplant broadcast for mass-audience events
- OTT TV is not really suitable as a platform for live streaming

streaming. A more substantial minority of 16% think it is unlikely ever to supplant broadcast, even though the technology is improving, while just under 8% hold that OTT is suitable for live streaming of niche-interest content only. (**fig. 1**)

Respondents were quite clear about the factors they believe are driving demand for live streaming among consumers. In short, cord-cutting trumps demand for additional content. Respondents take the view that live streaming is a substitute for broadcast rather than additive to it.

Cord-cutting and the trend for younger viewers to watch less broadcast television was cited as very important by almost three in five respondents, with a further third of respondents identifying it as moderately important.

The growing trend towards viewing content on devices other than the main TV screen in the home is also a significant factor, in the view of our survey sample. Over half – 53% – of respondents believe that the growing consumption of content outside the home on mobile devices such as smartphones is very important, with a further 35% taking the view that it is moderately important.

The habit of discovering and accessing content via social networks rather than linear TV services was meanwhile cited as very important by 39% and moderately important by 41%.

Growth factors associated with consuming more content are relatively less important, in the view of respondents.

Growing demand for content from sources other than major broadcasters and mainstream media providers was cited as very important only by around a third of respondents, with 48% believing it is moderately important. Demand for coverage of a wider range of content – for example, minority sports – than is catered to by traditional linear TV was said to be very important by just under a third of respondents and moderately important by 45%, while only 31% think that demand for more in-depth content than can be delivered via linear TV – for example extended coverage of major sports tournaments – is very important, and 45% think that it is moderately important. (**fig. 2**)

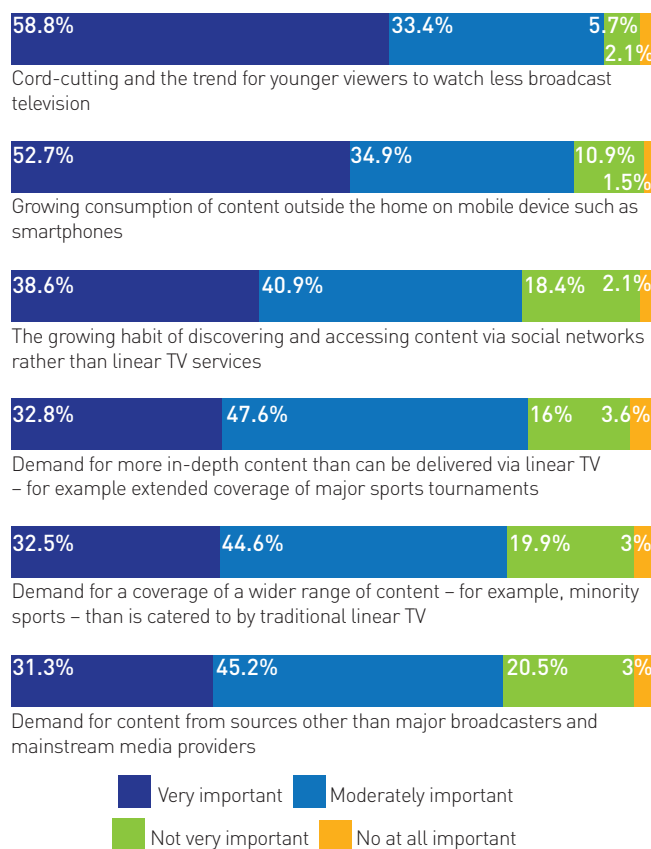
Challenges: latency and bandwidth

If OTT is ultimately to replace broadcast, it needs to be able to offer at least an equivalent experience.

The challenges of delivering coverage of major live events such as high-profile sports fixtures – one of the main content drivers of live streaming – are primarily being able to avoid latency and to scale quickly, at least in the view of survey respondents.

Asked what the main challenges faced by online video service providers when live-streaming major events such as sports tournaments are, half of respondents said that the difficulty of predicting demand and the need to secure adequate bandwidth to cope with peaks in

Fig. 2 Which of the following trends is driving the growth in consumer demand for OTT live streaming of sports, news and other live event coverage?



demand is a very significant challenge, while a further two in five said that this is a moderately significant challenge.

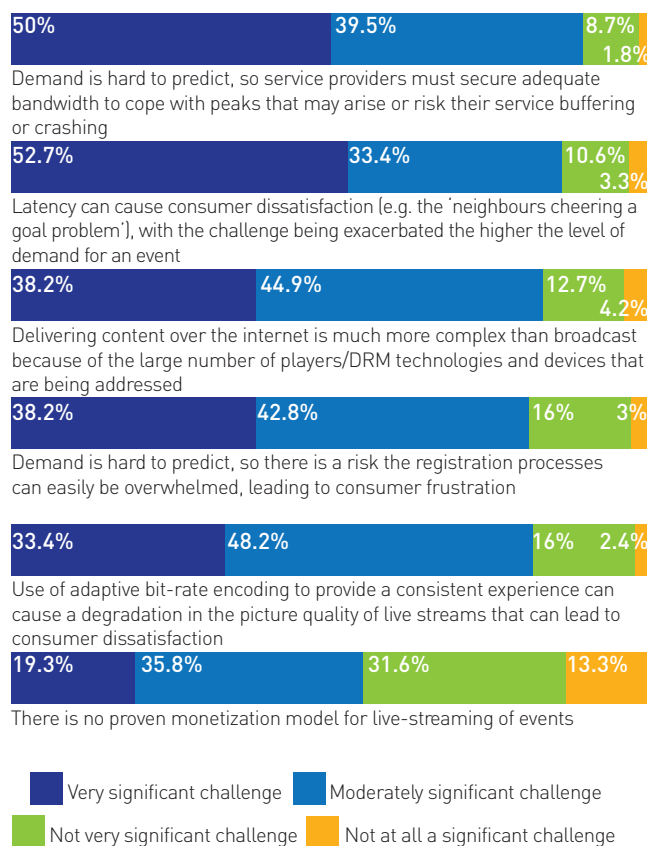
Just over half of respondents identified overcoming latency – particularly a problem in the case of highly time-sensitive sports events – as a very significant challenge, with this being exacerbated in the case of very high levels of demand to view an event. A further third of respondents thought this was a moderately significant challenge.

The complexity of the ecosystem is also seen as a significant challenge, with 38% identifying the complexity that results from the need to address multiple players and DRM technologies as a very significant challenge. Some 45% also identified this as a moderately significant challenge.

Associated with the need to scale quickly, the difficulty of predicting demand and the resulting threat that a registration process could be overwhelmed was identified as a very significant challenge by 38% and a moderately significant challenge by 43%.

Other challenges to be aware of include the danger that using adaptive bit-rate encoding to provide a consistent experience can

Fig. 3 What are the main challenges faced by online video service providers when live-streaming major events such as sports tournaments?



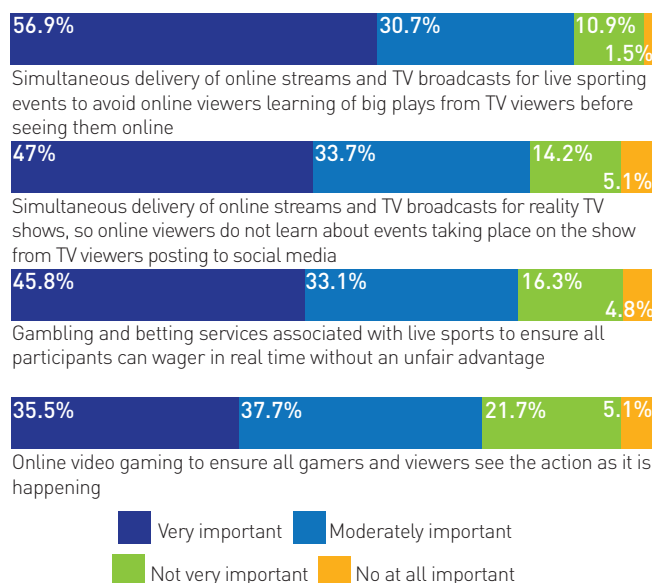
cause a degradation in the picture quality of live streams that can lead to consumer dissatisfaction. This is seen as very significant by a third of respondents and moderately significant by just under half.

Of much less concern to our survey sample is the commercial challenge of making money from live streaming of major events. Only 19% believe that the lack of a proven monetisation model for the live-streaming of events is a very significant problem, while 45% believe it is either not very significant or not at all significant. (fig. 3)

Diving deeper into the latency issue – identified as the single most important challenge alongside the need to scale quickly – respondents were asked to rate how significant this is across four typical use cases. Some 57% said that the difficulty of delivering simultaneous delivery of online streams and TV broadcasts for live sporting events to avoid online viewers learning of big plays from TV viewers before seeing them online was a very important problem, and 31% said it was a moderately important problem.

The danger of some viewers becoming aware of what's happening during a sporting fixture before others is seen as far more important

Fig. 4 How significant a problem is latency in live streaming for the following use-cases?



than any other single issue relating to latency.

However, respondents also believe that it is important, in the case of online video gaming, that all players and viewers see the action as it is happening. Some 47% see this as very important with a further third of respondents seeing it as moderately important.

Also important is eliminating latency for gambling and betting services associated with live sports to ensure all participants can wager in real time without an unfair advantage. Some 46% seek this as very important with a further third seeing it as moderately important.

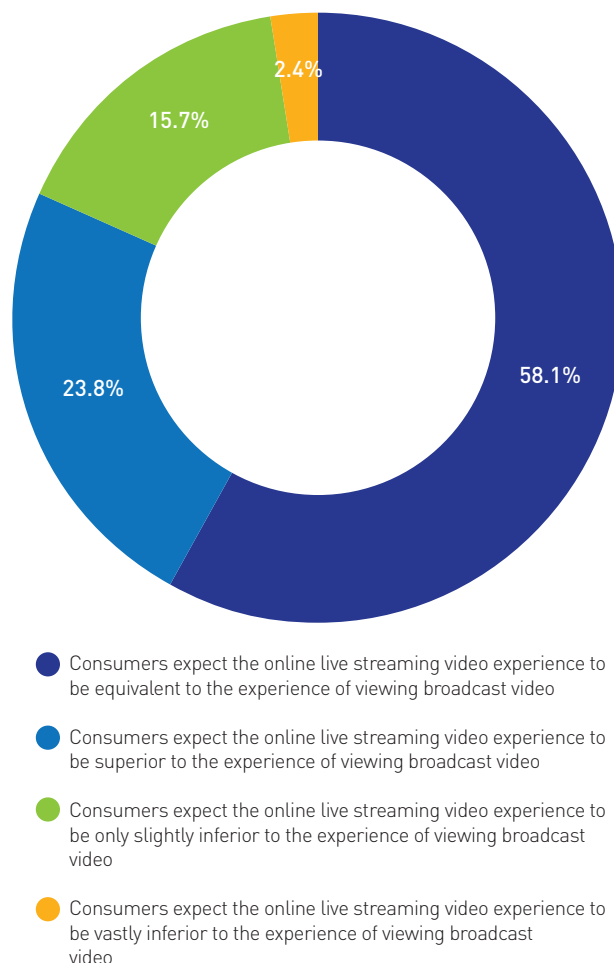
Of less urgency, at least in the view of this particular survey sample, is the simultaneous delivery of online streams and broadcasts for reality TV shows, so online viewers do not learn about events taking place on the show from TV viewers posting to social media. Only 36% see this as very important, although 38% see it as moderately important. (fig. 4)

Our survey indicates a general belief that consumers now have high expectations of online live video, far removed from the early days of putting up with buffering and dropped packets. Just under three in five survey respondents believe that consumers now expect the online live streaming video experience to be equivalent to the experience of viewing broadcast video, while 24% - almost one in four - believe that consumers expect the online live streaming video experience to be superior to the experience of viewing broadcast video.

Only a relatively small minority - 16% - believe that consumer expect the online viewing experience to slightly inferior to broadcast, and only about 2% hold consumers now believe the online live streaming experience will be vastly inferior to broadcast. (fig. 5)

Meeting those heightened expectations is however not

Fig. 5 Which of the following statements best expresses your opinion about the level of quality expected by consumers of live streaming video services?

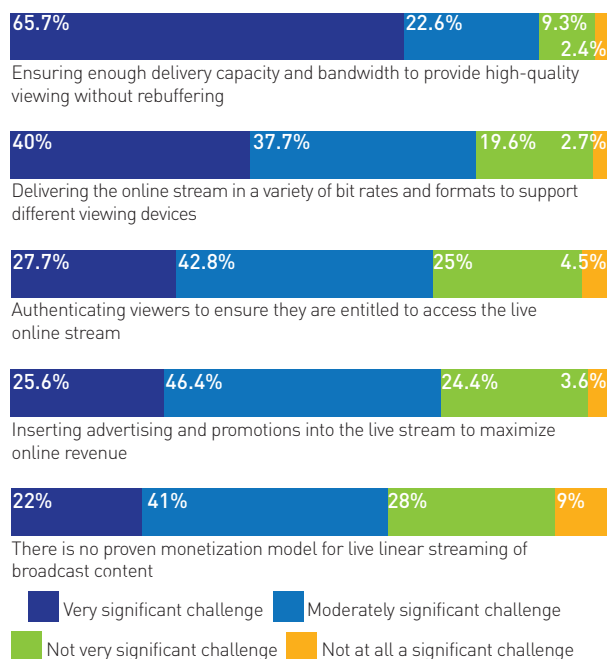


straightforward. While the live streaming experience has improved dramatically in recent years, matching broadcast quality is not a trivial exercise. Asked to identify the main challenges faced by online video service providers in streaming channels live, our survey respondents highlighted basic technical issues over and above operational and commercial challenges. In the view of respondents, by far the biggest challenge faced by providers is ensuring enough delivery capacity and bandwidth to provide high-quality viewing without rebuffering, with two thirds identifying this as a very significant challenge and a further 23% identifying it as a moderately significant challenge.

The other key challenge identified by respondents was also a technical one. Some 40% believe that delivering the online stream in a variety of bit rates and formats to support different viewing devices is a very significant challenge, with 38% believing it is moderately significant.

Relatively speaking, our survey sample believe that operational and commercial challenges are considerably less significant. Number three

Fig. 6 What are the main challenges faced by online video service providers when providing live linear streaming of television broadcast channels?



on the list was the operational challenge of authenticating viewers to ensure they are entitled to access the live online stream. This was identified as very significant by 28% and moderately significant by 43%, although about 30% believed it was either not very significant or not at all significant.

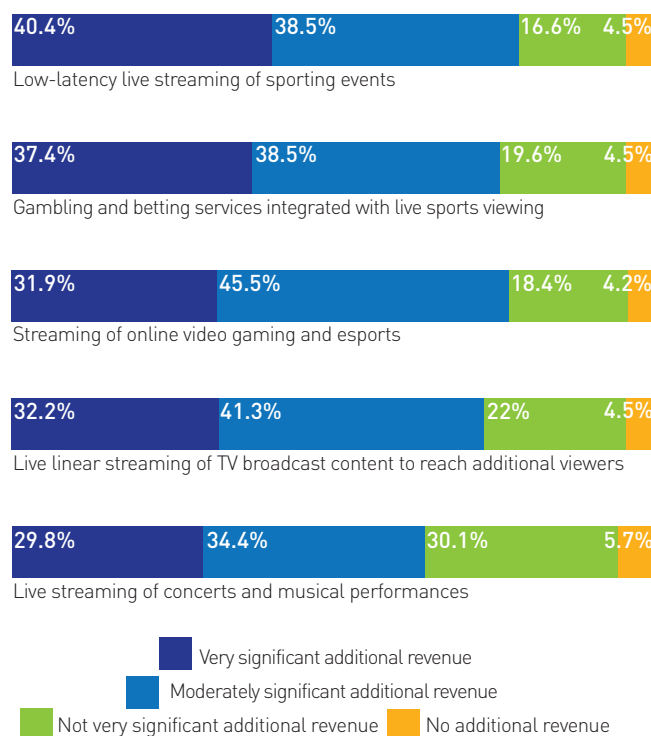
Inserting advertising and promotions into the live stream to maximise online revenue was meanwhile identified as very significant by 26% and moderately significant by 46%.

Respondents were less convinced that purely commercial challenges can get in the way of the development of live streaming. Only 22% thought that the lack of a proven monetisation model for live linear streaming of broadcast content was a very significant challenge, while 41% thought this was moderately significant. Some 37% though that this was either not very significant or not at all significant. (fig. 6)

Monetisation

While monetisation is not seen as a very significant challenge by our survey sample, respondents did not have a clearly defined view of which live-streaming use cases had the greatest potential to generate additional revenue for rightsholders.

Fig. 7 Which of the following live streaming use cases offer the greatest opportunity to generate additional revenue?



Asked to rate five live-streaming use cases for revenue potential, respondents failed to identify one single case as being markedly more compelling than the others. The highest score by a relatively narrow margin went, unsurprisingly, to low-latency live streaming of sports events, with 40% seeing this as having the potential to generate very significant additional revenue and 39% believing it had the potential to generate moderately significant additional revenue.

Respondents also had a broadly positive view of the related potential of gambling services integrated with live sports to generate cash. Some 37% saw this as generating very significant additional revenue and 39% as generating moderately significant additional revenue.

Broadly speaking, more respondents felt that the streaming of online video gaming – eSports – and the live linear streaming of broadcast TV content had the potential to generate additional revenue than believed the opposite. A slightly higher number of respondents had a negative view of the potential of live streaming of concerts and musical performances, with more of the survey sample believing this would not generate significant additional revenue than the proportion that believed it would generate very significant additional revenue. (fig. 7)



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Conclusion

Can live streaming replace broadcast TV? The general view of survey respondents is that it can, but it is not likely to do so in the very near future. Nevertheless, the fact that over one in five respondents believe that streaming could supplant broadcast today is instructive, and shows how perceptions are shifting.

In the meantime, growth in demand for live streaming of content is being driven by cord-cutting, meaning that viewers are increasingly looking online to find content they previously paid a pay TV subscription to see, and by the habit of viewing content on multiple devices. (The latter trend can, of course, benefit existing pay TV providers as well as content suppliers without their own pay TV infrastructure.) Respondents were less convinced that growth in live streaming is being fueled by demand for more content, or complementary content over and above what was traditionally supplied by TV operators. Live streaming is a substitute for traditional TV viewing rather than a complement to it.

Growth in live streaming is not pain-free. Consumers now expect live streaming to match or even exceed the quality of broadcast TV. The biggest challenge faced by providers, in the view of survey respondents, remains ensuring enough delivery capacity and bandwidth to provide high-quality viewing without rebuffering.

The challenge of delivering quality is amplified in the case of high-profile sports events and other live events. In these cases, the challenge of overcoming latency remains a major hurdle, while scaling up to meet sudden and unpredictable spikes in demand also remains a very significant challenge, in the view of respondents. The use case most commonly cited is providing coverage of a live sports events that is received simultaneously with the broadcast stream.

While making money from live streaming is not seen as a major challenge in itself, respondents do not share a consensus about which use case is the most promising. However, broadly speaking, low-latency delivery of live sports events is seen as having the greatest potential to deliver new revenues to rightsholders. ●



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The gigabit network

Introduction

The ability to deliver ever-faster broadband speeds is the major focus of service providers as they battle it out to win and keep subscribers.

The main priority is to deliver the highest possible speed, even if relatively few subscribers are currently taking up these offers.

Within this environment, the ability to deliver 1Gbps, or 10Gbps, carries immense weight. The cable industry recently launched an initiative entitled 10G, which is based on their vision of the ultra-high-speed network of the future and trademarked the term 10G to communicate it.

Beyond the marketing requirement to deliver headline-grabbing top-line speeds, operators have to ensure that they provide Quality of Service on their broadband networks. The most popular applications driving growing demand include streaming video and gaming – applications that demand not only fast but reliable connections.

The gigabit network

The 1Gbps benchmark

Ultra-fast fixed broadband networks are crucial to the delivery of next-generation video services. As video streaming has gained in popularity, in the near term, despite the growing interest in symmetrical bandwidth, 1Gbps downstream has emerged as one of the key marketing battlegrounds, with cable and telecom operators looking to their offer of 1Gbps services to capture the attention of potential subscribers, even if not everyone is yet willing to pay a premium for this.

Currently, only a minority of respondents – 31% – believe that 1Gbps will soon be the baseline broadband speed demanded by mainstream consumers. Nevertheless, a majority think that there are substantial numbers of internet users out there looking for this kind of connectivity, with 35% taking the view that 1Gbps will be a useful addition to operators' services for the significant minority of high-spending customers.

A much smaller group – 19% – adhere to the view, commonly expressed in industry circles, that 1Gbps is a useful marketing tool for broadband providers, but one that in practice will appeal to a very small minority of users, while 14% believe that 1Gbps is purely a marketing tool and not necessary for any real-world application now or in the near future. Just over 1% believe that 1Gbps is not necessary for any application and not useful for marketing. (fig. 1)

While there is some scepticism about the urgency of delivering 1Gbps services to meet real consumer needs, there is also some anxiety about the ability of network providers to keep up with demand by making sure their networks are fit for purpose.

Asked whether fixed-access networks will provide adequate bandwidth over the next five years, a majority of respondents endorsed the view that networks will need investment to keep up with demand for bandwidth, although opinions about how much investment will be required vary.

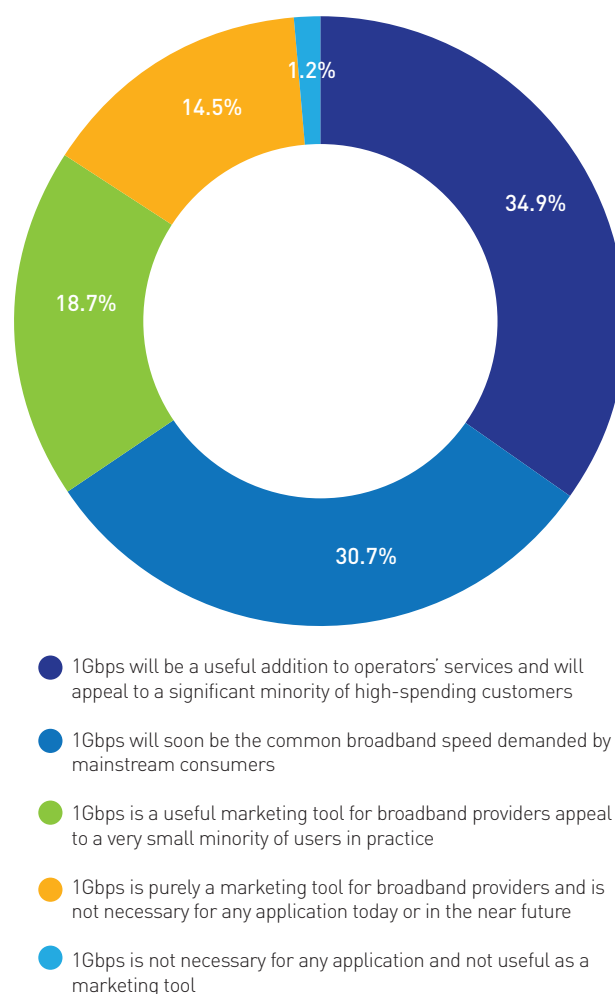
Some 27% of respondents believe that overall, current fixed-line networks are not adequate to meet demand for bandwidth over the next five years, but can be made so with some investment in the existing network, while 21% believe networks can only be made fit for purpose with considerable investment. A further 13% believe that current fixed-line networks are not adequate to meet demand for bandwidth over the next five years, and will need to be replaced with FTTH networks.

Only 13% have complete confidence that current HFC and copper networks are already adequate to meet demand for bandwidth over the next five years without additional investment. (fig. 2)

Applications

Scepticism about the need for 1Gbps and higher speeds is based on the assumption that there is no application that exists currently or is likely in the near future that will result in demand of such intensity as to require this kind of capacity.

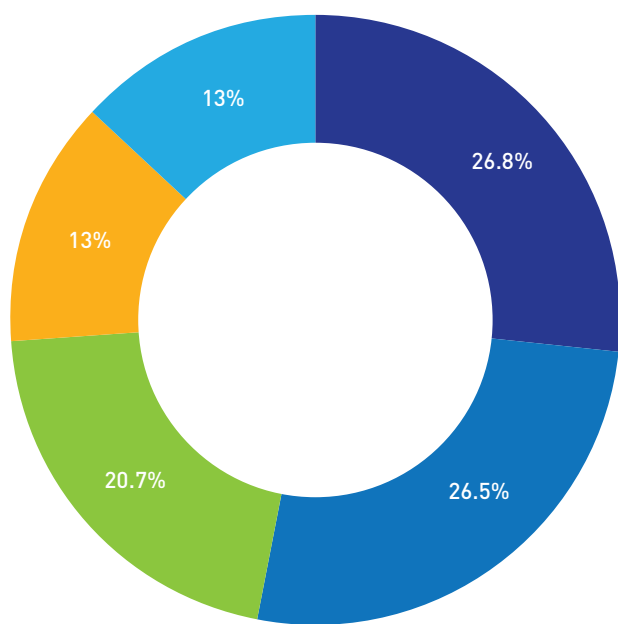
Fig. 1 Which of the following statements best expresses your view about the rollout of 1Gbps broadband services by fixed-access network operators?



While future applications could emerge that will drive a dramatic upwards spike in demand for downstream and/or upstream bandwidth, current applications that drive demand for capacity including video streaming, gaming, ultra high-definition video, smart home applications, IoT, video conferencing, cloud storage and remote work site working are likely to be key in determining future demand for capacity.

We asked survey respondents to assess which of these applications is likely to have a major impact in demand for Gigabit capacity over the next five years. Unmanaged video streaming came top of the list, with close to half of respondents of the view that this would have a very big impact. A further two in five believe unmanaged video streaming will have a big impact.

Fig. 2 Which of the following statements best expresses your view about whether fixed-access networks will provide adequate bandwidth over the next five years?



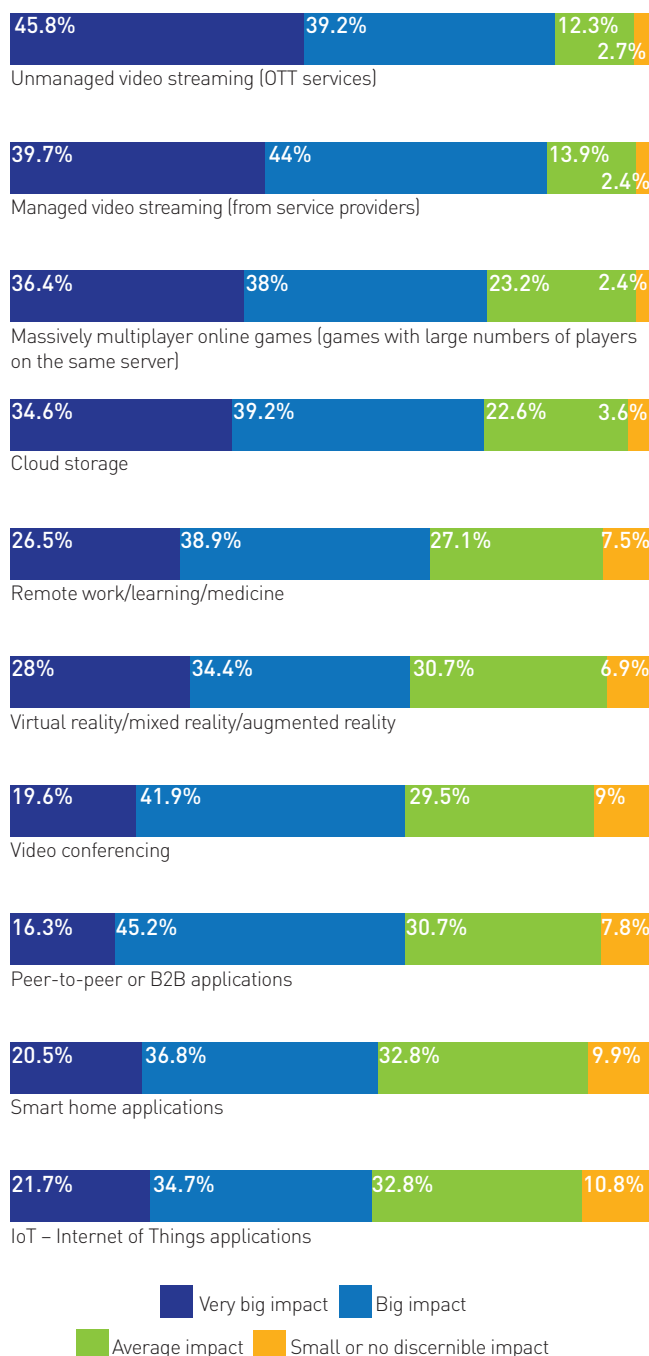
- Overall, current fixed-line networks are not adequate to meet demand for bandwidth over the next five years, but can be made so with some investment in the existing network
- Overall, current fixed-line networks are adequate to meet demand for bandwidth over the next five years but networks will benefit from some additional investments
- Overall, current fixed-line networks are not adequate to meet demand for bandwidth over the next five years, but can be made so with considerable investment in the existing network
- Overall, current fixed-access networks (copper, HFC) are more than adequate to meet demand for bandwidth over the next five years without additional investment
- Overall, current fixed-line networks are not adequate to meet demand for bandwidth over the next five years, and will need to be replaced with FTTH networks

Managed video streams – in other words video streams delivered by the service provider over its managed network – also score highly, with 40% believing these will have a very big impact and 44% taking the view that they will have a big impact.

While video streaming – both unmanaged and managed – sits on its own at the top of the list, respondents also expect massive multiplayer online gaming – i.e. gaming with large numbers of players on the same server – will have a significant impact. Among the respondents, 36% believe it will have a very big impact and 38% that it will have a big impact.

Also expected to have repercussions on demand for capacity is cloud

Fig. 3 How big an impact do you think the following applications will have on demand for Gigabit capacity over the next five years?



storage, with a total of 74% taking the view that it will have a big impact or a very big impact.

Relatively less important in the view of respondents are virtual reality and augmented reality applications and remote work/learning/medicine, although these applications are also expected to have a

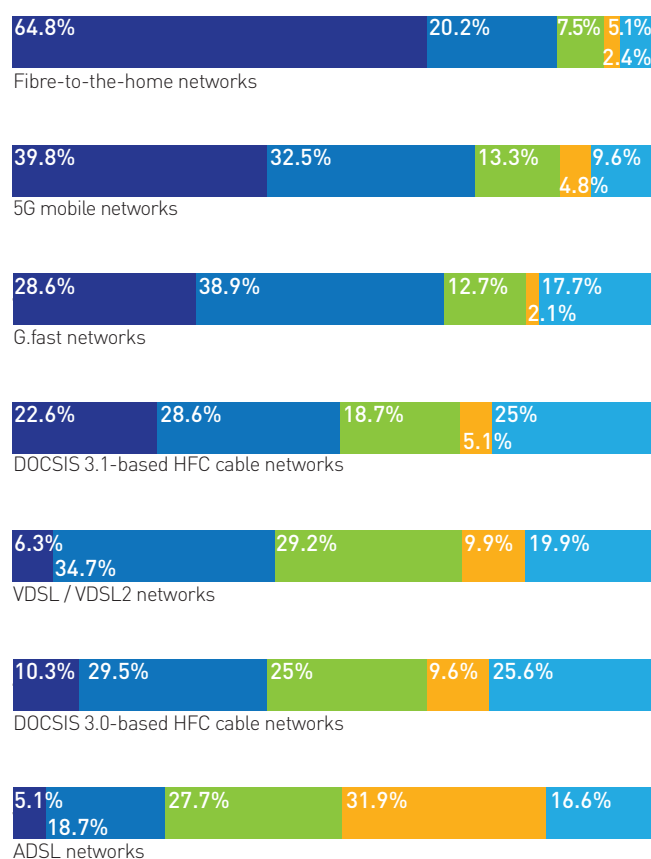
significant impact on demand. Further down the list are smart home applications, video conferencing, peer-to-peer, B2B applications and the Internet of Things, with just under 22% taking the view that the latter will have a very big impact. While these applications are still expected to have an impact on demand for capacity, they lag well behind video, at least in the view of respondents, who, it should be remembered, hail from the video distribution industry. (fig. 3)

Network technology

Regarding which network technologies are capable of meeting demand for video and other applications over the next five years, respondents are clear in their view that fibre-to-the-home is best and ADSL fails to make the grade, but there is less consensus about the merits of DOCSIS-based HFC networks.

Some 65%, or two thirds, of respondents believe that FTTH networks

Fig. 4 How do you rate the following types of telecom network for their ability to meet demand for video and other applications over the next five years?



are highly adequate to meet demand over the next five years, while a further one in five think fibre will be moderately adequate.

At the other end of the scale, only 5% believe ADSL will be highly adequate, compared with almost half who take the view that this technology will either be not really or not at all adequate.

VDSL and VDSL2 networks – copper access networks supercharged by deep fibre – also get short shrift, with only 6% believing these will be highly adequate.

G.fast, also a supercharged DSL technology, in this case with local loops shorter than 500 metres, fares somewhat better, with 29% believing it will be highly adequate and 39% thinking it will be moderately adequate, although some 20% of respondents admit to not knowing how this technology will perform.

There is less consensus about cable networks. Some 10% of respondents believe DOCSIS 3.0-based networks will be highly adequate, and 30% think they will be moderately adequate. Conversely, 35% take the view that they will be not really or not at all adequate.

The newer DOCSIS 3.1 technology fares better, with 23% believing it will be highly adequate over the next five years and 29% taking the view that it will be moderately adequate. In each case 25% admit to not knowing how effectively DOCSIS will perform.

Strangely perhaps, respondents have more faith in yet largely untested 5G mobile technology, with 40% believing this will be highly adequate and only 10% admitting to not knowing. (fig. 4)

Symmetrical bandwidth

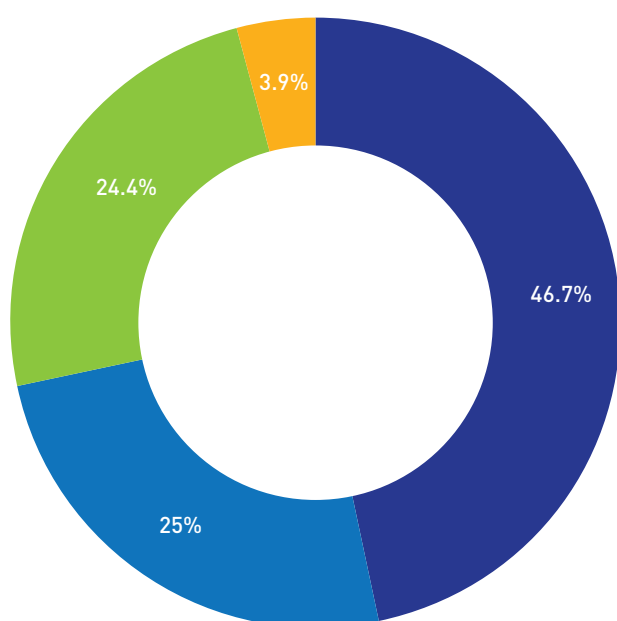
The ability to offer symmetrical bandwidth is increasingly seen as an important marketing tool by broadband operators, but there is scepticism about whether it is actually useful to the majority of consumers. The decline of peer-to-peer activity in favour of streaming services has meant that growth in demand for downstream capacity has even out-accelerated demand for upstream bandwidth.

We asked survey respondents to share their views on how useful or necessary symmetrical bandwidth is to consumers and service providers. Asked to choose one of four statements that best expressed their viewpoint, 47% agreed that demand for symmetrical bandwidth will grow slowly because it appeals only to a subset of consumers, while only 25% took the view that demand is growing rapidly and service providers will ignore this at their peril.

Some 24% endorsed the view that demand for symmetrical bandwidth will be limited to the enterprise market while a very small group – 4% – believe demand is virtually nonexistent and likely to remain so for some time. (fig. 5)

Respondents also believe that demand for downstream capacity will continue to race ahead of upstream. Some 38% think that fixed-access network providers should anticipate a compound annual growth rate of 50% or greater for downstream capacity, compared with 18% who believe the same for upstream. At the lower end of the CAGR range, only 3% of respondents think operators should expect a downstream CAGR of less than 20%, while 15% believe upstream CAGR will come in below this level. (fig. 6)

Fig. 5 Which of the following statements best expresses your view of how useful or necessary symmetrical bandwidth (where upstream speeds match downstream speeds) is to consumers and service providers?



- Demand for symmetrical bandwidth will grow slowly because it appeals only to a subset of consumers
- Demand for symmetrical bandwidth is growing rapidly and service providers will ignore this at their peril
- Demand for symmetrical bandwidth will be limited for the most part to the enterprise market
- Demand for symmetrical bandwidth is virtually nonexistent and likely to remain so for some time

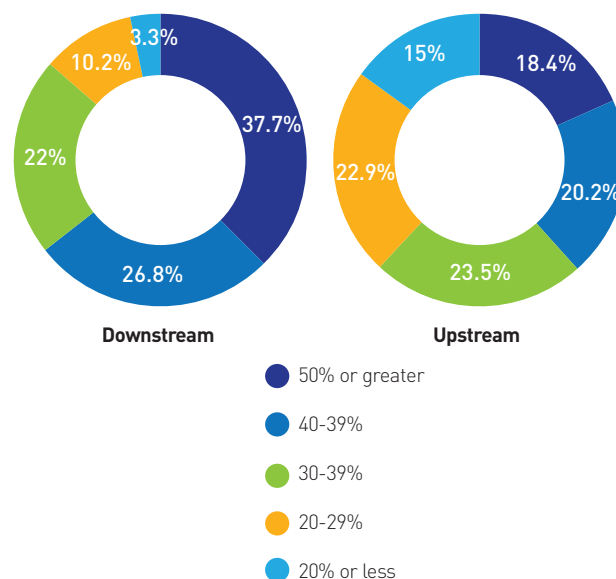
Challenges

Given the expected rate of growth of demand for downstream capacity, it is perhaps no surprise that the biggest challenge facing service providers as they look to provide consistent Quality of Experience, in the view of respondents, is providing adequate bandwidth to support the full range of applications that subscribers want. Some three in five respondents identified this as a very significant challenge, with a further three in ten identifying it as moderately significant.

Over half of survey respondents also believe that meeting customer expectations about Quality of Experience across multiple services from third-party providers, such as Netflix and other OTT players, is a very significant challenge, with a further 38% thinking it is moderately significant.

The third major challenge identified by respondents is providing

Fig. 6 What downstream and upstream bandwidth compound annual growth rate (CAGR) should fixed access network providers anticipate when investing in their network?



adequate WiFi coverage within the home to support the full range of consumer applications with consistent quality. Over half believe this is very significant and 34% think it is moderately significant.

Of marginally less concern, in the view of our survey sample, is the challenge of supporting retail devices and – coming last in our list of five potential challenges, maintaining and replacing operator-owned CPE devices over time. That is not to say that these are not important challenges in their own right: some 39% believe that delivering Quality of Experience over retail devices is very significant and 45% believe it is moderately significant. Approximately one third believe that maintaining and replacing operator-owned consumer premises devices over time is very significant and almost half believe it is moderately significant. (fig. 7)

Conclusion

Fast download speeds remain a major battleground between fixed-line broadband service providers, with 1Gbps currently emerging as the benchmark. While only a minority of respondents currently believe that 1Gbps will be the baseline expected in the very near future, the majority think that 1Gbps will be a useful addition to operators' offerings, with a significant minority of users willing to pay for such a service.

For those surveyed, streaming video will continue to be the main driver of bandwidth demand in the near future. This means that demand for downstream capacity is likely to continue to outpace demand for upstream capacity. There are other applications that may drive demand for greater upstream capacity, but video continues to be the leader in overall demand.



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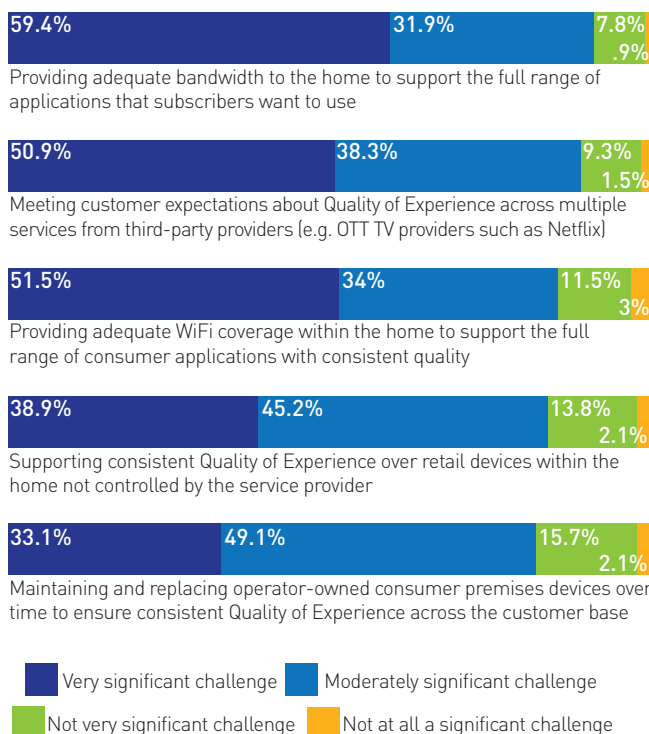


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Fig. 7 What are the most important challenges currently faced by residential broadband service providers as they look to provide consistent Quality of Experience to subscribers of high bandwidth services?



Unsurprisingly, respondents take the view that fibre-to-the-home networks are best-placed to meet consumer requirements for higher bandwidth, but there is a degree of uncertainty about how efficient HFC cable networks will be in delivering ultra-fast broadband.

Given their view that streaming video is the key application, it is perhaps not surprising that respondents are somewhat sceptical about whether there is an urgent need to deliver symmetrical bandwidth offerings. Most therefore believe that demand for downstream capacity will continue to race ahead of requirements for upstream speed. The biggest challenge, in the view of survey respondents, remains that of delivering sufficient bandwidth to support the types of services that consumers really want to use. ●

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