

The Evolution of Big Video

Examining telco transformation video opportunities

Contents

Executive summary	4
Where are we now? IP-video distribution in 2016.....	4
Telco video transformation is already under way	4
Differentiating through UHD: Taking video quality to the next level.....	5
Video quality is critical for managing churn	7
Distributing video over cellular networks.....	8
Live streaming has hit the social media mainstream	8
The emergence of virtual and augmented reality in 2016.....	8
Virtual reality adoption in the consumer market.....	9
Video calling hits the mainstream.....	9
Video in the enterprise: A growing opportunity.....	10
Enterprise video communication: Expanding from the boardroom to the entire company	11
Video surveillance: A key component of managed security solutions.....	11
Evaluating enterprise use cases for VR and AR.....	11
How consumer video consumption is evolving	11
Global online video usage.....	11
Examining the mobile video consumer	12
Regional variations in online video consumption.....	13
Leading markets: A mature broadband user base.....	14
Evolved markets: Higher online video adoption and a growing mobile viewership.....	14
Evolving markets: Primed for mobile video expansion	15
Examining the video opportunities for network operators	15
Products and services.....	15
The original telco video initiative: IPTV.....	15
OTT video: From Netflix to network operator	16
The growing importance of video communications: Calling, chatting, and conferencing	16
Enterprise video streaming use cases	17
The fastest data growth is on cellular networks	17
Telco network advantages.....	18
New technologies and their impact on video delivery.....	18
The importance of speed: The advent of ultra-broadband networks	19
Improving video quality over cellular: The impact of 5G rollout.....	19
Fixed broadband continues to evolve.....	19
Cloud computing.....	20
Telco OS	20
Looking ahead: Recommendations for video-centric network operators.....	21
Long-term strategy: Big video as a basic service	21
Transforming data networks to video-centric networks	22
Innovating data monetization	22
Driving video ecosystem cooperation – an operator imperative.....	22

Executive summary

As distribution of IP video has scaled and become central to the commercial strategies of a host of companies, the industry is entering a new stage regarding the technology and infrastructure that is being deployed to support enormous growth in demand. This is a critical inflection point in the evolution of entertainment and enterprise video distribution: as demand for all types of video services grows exponentially, there are huge opportunities – and threats – facing all segments of the value chain.

We believe that companies who wish to build sustainable video businesses – not just for the next two or three years, but for the next fifty – must aggressively assert themselves to define and protect their roles in the video ecosystem. This is a period of significant change and while there are opportunities for each segment of the value chain, this white paper will focus on the current situation for operators providing video service for the entertainment and communications markets, as well as vertical industry segments. The critical transformation that operators must evaluate and execute in the near term is to pivot from treating their networks as conduits for data and move toward video-centric networks.

Given the proportion of data that is attributable to video distribution and that the growth in annual consumption of data is almost wholly attributable to video, it is no longer reasonable to strategize purely for data.

The critical transformation that operators must evaluate and execute in the near term is to pivot from treating their networks as conduits for data and move toward video-centric networks.

The key messages for operators who wish to undertake the transformation from data-centric to video-centric are:

- Video has become an integral component of most players' operational strategies. Moreover, several telecoms operators have defined video as a basic pillar of their business.
- A growing number of telcos are exploring new means of deploying a wider range of video services more rapidly and successfully.
- Operators must leverage their unique position as network owners and keepers of the subscription relationships with end users.
- As controllers of the network and the technical infrastructure underpinning video delivery, operators have a critical role in driving the creation and growth of entire video ecosystems.
- Given these advantages, we believe that now is the time for operators to assert themselves and to take a leading role in driving the growth and shape of both the enterprise and entertainment video ecosystems.

Where are we now? IP-video distribution in 2016

Telco video transformation is already under way

In 2016, the vast majority of "traditional" pay-TV services are now supplemented by various IP-based enhancements. While adoption of traditional subscription TV services continues at a steady but relatively moderate pace globally, OTT and mobile video services are emerging as big growth areas for content providers and distributors alike.

In pay TV, telcos have made slow but steady progress, accounting for around a fifth of global subscriptions at the end of 2015. Telcos' expansion beyond their IPTV networks into satellite, cable, and OTT distribution is having a substantial impact on the video industry. Specifically, M&A activity is enabling telcos to accelerate their standing in the TV market, in many cases transforming their competitive position from that of challenger to leader. Among the recent spate of major telco M&A initiatives in the pay-TV and video

entertainment market are AT&T's acquisition of DirecTV, Verizon's purchase of AOL (as well as its imminent takeover of Yahoo's web business), and Vodafone's expansion into the cable and triple-play markets through its ownership of Kabel Deutschland and the Spanish operator ONO.

Differentiating through UHD: Taking video quality to the next level

All TV service providers have to evaluate their positioning regarding the deployment of UHD linear TV and VoD services. Currently, UHD deployments are confined largely to IPTV and OTT services; however, there will be a significant proliferation of launches in the second half of 2016 as European TV providers use the new English Premier League season as a driver for UHD service launches.

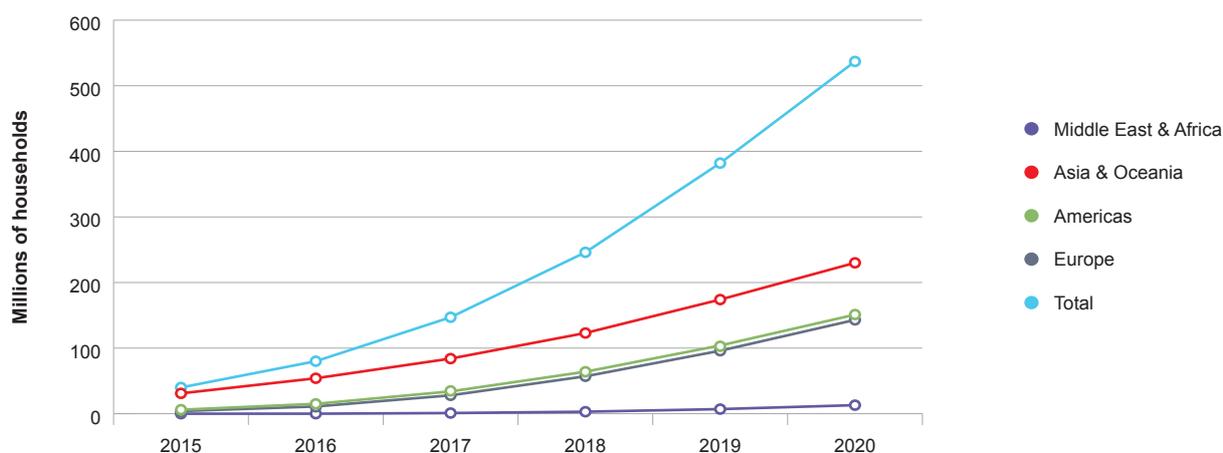
Operators face two challenges: the increased burden on their networks of third-party UHD distribution and how they wish to incorporate UHD distribution into their own service offerings. UHD video and TV availability will have a major impact on the market: the emphasis on a differentiated level of video quality may enable higher prices. In order for operators to manage the increased network burden, it is critical that they monetize this additional data burden, not just for day-to-day operations but also to ensure that funding is available to maintain network investments to keep pace with growing audience demand for UHD services.

Despite some constraints – such as high prices for 4K UHD TV sets, limited availability of 4K-native content, and bandwidth limitations – pay-TV operators are demonstrating their commitment to launching 4K UHD services and are promoting them along with set-top-box upgrades. Penetration of 4K UHD is set to increase from just 2.5% in 2015 to 30% in 2020. Slow adoption of high-speed broadband services at a global level will present a significant obstacle to more rapid growth.

Penetration of 4K UHD is set to increase from just 2.5% in 2015 to 30% in 2020.

We estimate that in 2015 global sales of 4K UHD TVs reached 22.4 million units, an increase of 90% over the previous year. At the same time, 4K UHD TV sales exceeded 10% of total TV sales globally. Price decreases and the introduction of new 4K UHD pay-TV services will boost 4K UHD penetration to nearly half of total TV households by 2020. After China and the US, Germany and the UK will become the world's third and fourth biggest 4K UHD markets, respectively.

Figure 1: Global UHD household forecast, 2015–20



Source: Ovum

Telcos account for more than half of the 4K UHD implementations outlined in Table 1 below. These developments highlight telcos' tendency to remain at the forefront of technical innovation.

Table 1: 4K UHD pay-TV services: chronology of launches

4Q13	Netflix** adds first 4K titles to its online streaming library
1Q14	UHD pay-TV trial by Japanese NTT* (STB-based; vendor: Sumitomo)
2Q14	KT Corporation* (South Korea) launches the world's first UHD pay-TV service, called "Olleh GiGA UHD TV"
3Q14	DirecTV (US) launches its first non-STB RVU (Remote Viewing)-based 4K UHD pay-TV service
	China Telecom* Sichuan launches the first commercial 4K UHD STB service in China (developed with Huawei)
4Q14	Comcast becomes the second US pay-TV operator to launch a UHD pay-TV service (non-STB, Samsung app)
	Amazon** and M-Go* launch 4K UHD offers
1Q15	Dish Network (US) launches the first 4K STB service among US pay-TV operators
2Q15	Free* (France) launches its first "Mini 4K" STB
3Q15	BT* launches YouView box, the first UHD STB in the UK
	DirecTV unveiled its first 4K STB, the Genie Mini
	Videotron (Canada) launches a 4K UHD commercial service
	Totalplay* (Mexico) launches the first UHD STB in Latin America
4Q15	SFR* (France) launches a UHD gateway, La Box Fibre Zive
	UltraFlix** launches its 4K offer on Roku 4
1Q16	Etisalat* (UAE) launches the Middle East and Africa region's first UHD 4K IPTV service
2Q16	Swisscom* launches its TV UHD Box 2.0
	Vodafone* Portugal launches TV Box 4K
<small>Note: *Telco; **OTT player Source: Ovum</small>	

Introduction: Operator perspectives on the potential of video-centric network strategies

We are including some recent thoughts from global operators regarding the issues covered in this paper. Responses are anonymized to encourage free thinking and strong opinions, but are all gathered from multinational, globally recognizable telecommunications operators and technology vendors who are heavily invested in the video business. Their perspectives appear later in this report, in a box like this one, and are accompanied by our view of the issue at hand.

What are the most significant video opportunities available to network operators?

Attention is focused on the potential of video delivered over cellular networks and the growing adoption of UHD TV and video across the entire visual entertainment value chain. Consumers love video on mobile devices but not streaming video over cellular networks. This is because of a "lack of clarity over the amount of data used... 'How much data does an hour of video use?'"

While bill shock has historically constrained mobile video volumes, 4G increasingly addresses this with significantly larger data allowances. However, until there is sufficient penetration of such deals in a given market, video consumption over cellular will remain constrained and the willingness of companies to undertake the necessary experimentation to identify viable business models will not occur. There is a significant opportunity but operators are exercising caution in rightsizing mobile video investments until there is a clear indication of a viable and sustainable commercial model, particularly when new network technology investments such as LTE Broadcast are considered. Some operators are investigating the potential of a separate tariff or commercial model for video data entirely.

We agree with the perspective that: "Every platform and every content originator is working on 4K strategy."

BT Sport offers a UHD linear sports channel on its IPTV service and high-speed broadband bundle, but this is currently an exception. We expect a rash of UHD channel launches with the beginning of the new English Premier League season in late August alongside pay-TV UHD movie channels.

UHD's potential for network operators lies in the significant uptick in data volumes required to deliver higher-resolution video. The quality of video user experience, however, does not end at resolution: multiple other factors such as video quality (blocking) and responsiveness of interactive functionality (requires very low RTT) also contribute to the level of user experience, which justifies relatively high price points.

Virtual reality (VR) was also cited as a driver of data revenues, though the timing was deemed uncertain. Early deployments have relied on data rates in the region of 10Mbps; however, this can rise exponentially as higher resolutions are used. This depends on broad market adoption of the technology, however.

While OTT players are also among the early movers in UHD subscription video-on-demand (SVoD) deployment (despite technological limitations), their 4K offers are limited by relatively small content libraries. The leading OTT operators, Netflix and Amazon, for example, have surprisingly scant 4K content offers compared to niche players such as M-Go and UltraFlix.

The relative dearth of desirable 4K content available on OTT platforms highlights a growing opportunity for network-based pay-TV operators to address latent demand for 4K adoption by stepping in to provide the required content services and customer premises equipment (CPE) as well as the supporting network infrastructure.

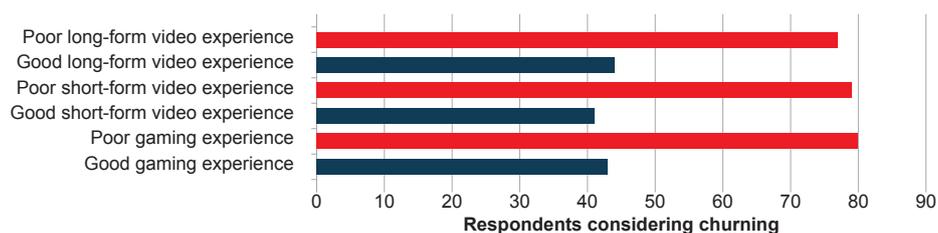
The leading OTT operators, Netflix and Amazon, for example, have surprisingly scant 4K content offers compared to niche players such as M-Go and UltraFlix.

Video quality is critical for managing churn

Enabling high-quality video user experiences is important not only for driving video business growth but also for providing a key defensive position for operators: customers who receive a better video experience are less likely to change broadband provider.

In an Ovum survey, 28% of respondents stated that they had changed their broadband service provider within the past 12 months – 64% of them in order to gain a more reliable service or faster speed. Over 2016, 54% of respondents stated that they would consider churning – again, largely to get a faster connection or a cheaper deal (or both). Figure 2 shows those respondents that are considering churning from their current service provider, based on the experience they received on certain media applications over the past 12 months. It is clear that those who currently receive a poor experience from their media applications are twice as likely to consider churning from their current broadband service provider.

Figure 2: Customer desire to churn doubles with poor video experience



Source: Ovum; N = 15,000

Distributing video over cellular networks

As video rapidly increases its share of overall data traffic through 2020, the mobile video market will present not only significant opportunities for media companies and advertisers to reach young, connected consumers, but also challenges for network operators as they must handle the traffic, delivering freely available ad-supported video-on-demand (AVoD) and live streaming video services.

It is clear that those who currently receive a poor experience from their media applications are twice as likely to consider churning from their current broadband service provider.

Live streaming has hit the social media mainstream

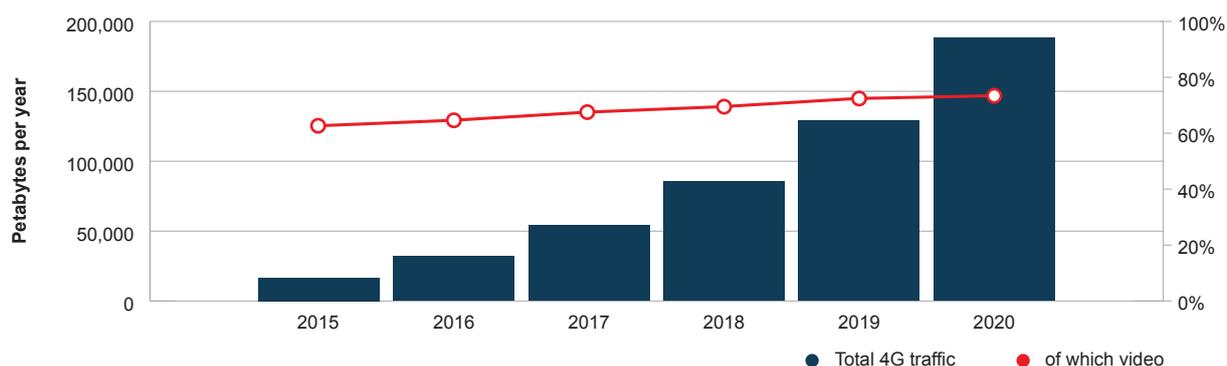
Mobile live streaming services are mainly free for consumers to access on social media platforms in a bid to grow substantial user bases. But as these user bases grow, and more content is delivered through live OTT broadcasts, so will the resulting burden on operators' networks. These same operators are facing the need to invest in their networks to support the increased demand for mobile video services without compromising quality of service in order to keep their customers happy and reduce churn.

Two high-profile, generalized mobile live streaming apps – Meerkat and Twitter-backed Periscope – launched in 2015. Both apps quickly attracted a substantial user base – with Periscope reporting 110 years' worth of video watched each day and over 200 million broadcasts having been created as of March 2016, one year since its launch.

Facebook's decision to start the rollout of live streaming capability to everyone on its platform through its mobile apps in December 2015 is likely to bring social live streaming to the mainstream. In January 2016, the company reported 500 million daily video users and 100 million hours of video per day consumed via the Facebook platform.

Mobile video traffic (excluding Wi-Fi) will increase tenfold during the five years to 2020; this is something network operators will need to address at both a business and technology level.

Figure 3: 4G video traffic forecast, 2015–20



Source: Ovum

The bulk of traffic carried over telco networks is generated by third parties. If telcos cannot fully monetize this huge growth in external traffic, they must at least take measures to optimize their networks, enabling more efficient and cost-effective distribution of video.

The emergence of virtual and augmented reality in 2016

This is VR's year to shine as video game makers in particular embrace the medium. The combined effect of high-end headsets becoming available, content creators getting on board, and virtually any new smartphone

coming with the option of a VR headset accessory is translating to lots of industry excitement, media coverage, and early adopter demand.

If telcos cannot fully monetize this huge growth in external traffic, they must at least take measures to optimize their networks, enabling more efficient and cost-effective distribution of video.

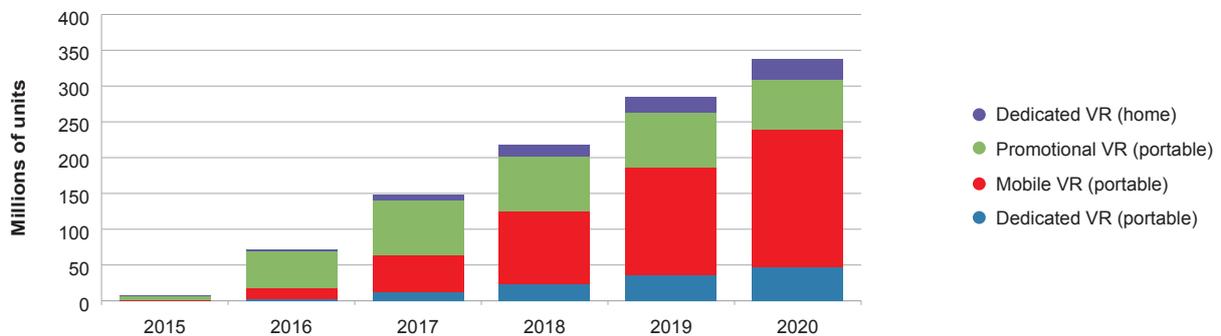
Telcos and infrastructure providers will focus on reliable network access with the advanced networks outlined in the "New technologies and their impact on video delivery" section below. VR and AR applications that rely on OTT or mobile data (as opposed to, say, a physical disc in the case of video gaming) will have the most significant impacts on operator networks. Because one of the use cases for VR is in enabling people to communicate, it is likely that the adoption rates of consumer VR will be significant in determining the data demands of VR.

The most significant mobile AR app is Pokemon Go and its global success may kick-start this segment. Pokemon Go relies on data over cellular networks, because the basic premise of the game is that the player must play while walking.

Virtual reality adoption in the consumer market

Ovum projects that the total VR installed base will grow from 71 million to 337 million devices between 2016 and 2020. Promotional VR will lead "sales" until 2017, with disposable experimentation devices predominating before consumers shift to mobile VR, which will contribute 65% of sales by 2020. Dedicated VR device volumes will remain small with 19–21% market share between 2018 and 2020.

Figure 4: VR installed base (consumer only), 2015–20

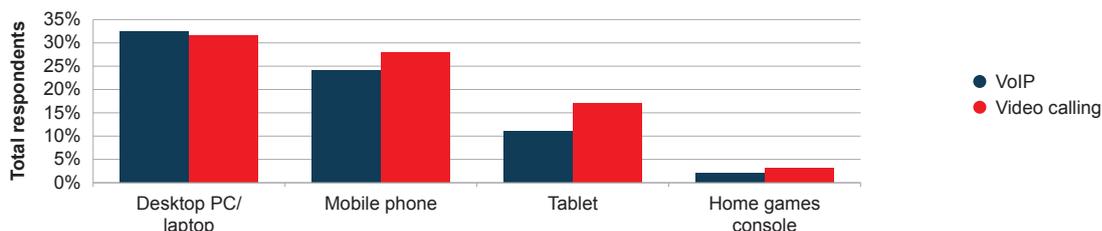


Source: Ovum

Video calling hits the mainstream

The voice- and video-calling services offered by OTTs are also being used extensively according to Ovum's 2015 Consumer Insights Survey, which found that 51.3% of 10,000 respondents used an app-based VoIP service and 55.9% used an app-based video-calling service, via their desktop/laptop, mobile phone, tablet, or games console.

Figure 5: Consumer use of VoIP and video calling (October 2015)

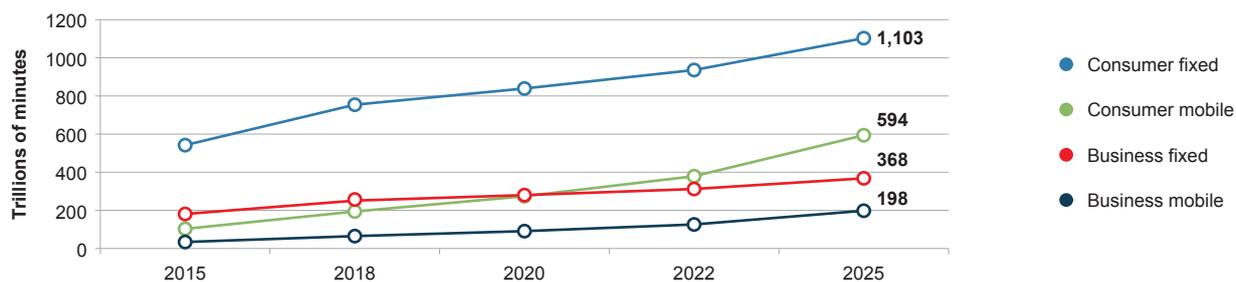


Source: Ovum; N = 10,000

Throughout 2016 and beyond, penetration of app-based VoIP and video calling will increase in line with the growing penetration of fixed and mobile broadband and of smartphones. While our research indicates that consumer app-based video chat penetration is already slightly higher than VoIP, frequency of usage remains significantly lower for video chat, which is popular among early adopters but has not yet become a mainstream activity.

Video calling – for which volumes across consumer and business segments are projected to grow at a CAGR of 10% between 2015 and 2025 – has the opportunity to go more mainstream if pushed by the communications service providers (CSPs). The current most popular video-calling services across desktop PC or laptop and mobile are Skype, FaceTime, and Facebook Messenger, but other new players will enter the market in the future. Telcos will inevitably need to respond to this and add video into their converged communications services in order to remain relevant to the end user. One operator, T-Mobile (US), is already addressing this challenge with its Rich Communications Services (RCS)-supported Advanced Messaging product, to which it added video-calling capability in September 2015. The service had gained more than 5.5 million users, who were sending an estimated 40 million messages daily by the end of February 2016. According to Ovum’s internal forecasts, video calling will account for 6% of the world’s fixed calling traffic by 2020, by which time the global fixed voice service market will be worth a projected \$134.7bn.

Figure 6: Global video-calling traffic forecast, 2015–25

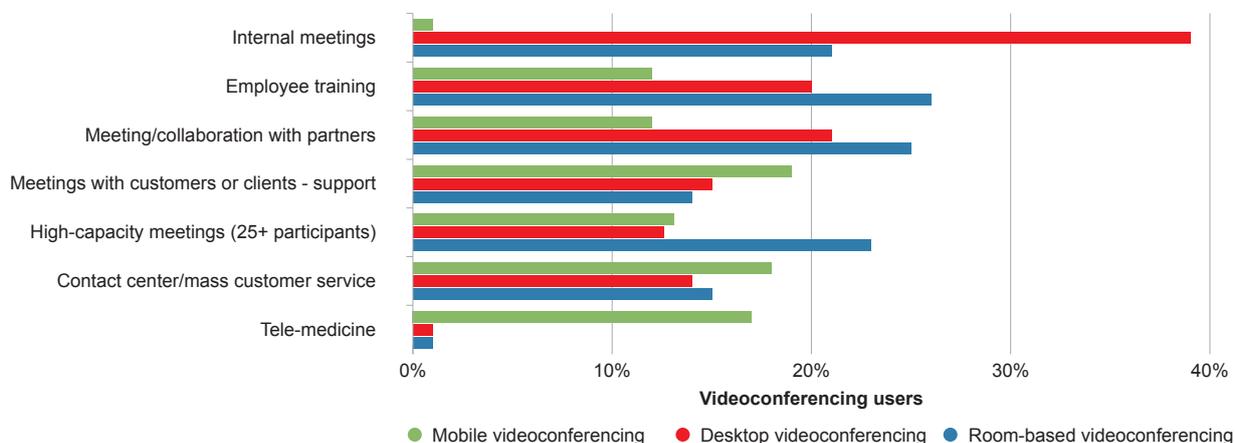


Source: Ovum

Video in the enterprise: A growing opportunity

Video applications are being used for an increasing range of functions by enterprises across the full spectrum of industry verticals. While communications remain the primary use for video in the enterprise, a number of additional functions are gaining traction among businesses of all sizes.

Figure 7: Key uses of videoconferencing



Source: Ovum; N = 2,708

Enterprise video communication: Expanding from the boardroom to the entire company

Once the preserve of only the most senior levels of enterprise executives, video communications has effectively broadened its usage from the boardroom to the entire office. By far, the longest-established, most widely used video application among enterprises is videoconferencing.

Video calling will account for 6% of the world's fixed calling traffic by 2020

Video surveillance: A key component of managed security solutions

One of the most widely used M2M applications is surveillance video deployed as part of managed security solutions, whereby cameras are connected wirelessly and alarm systems use Internet connections to alert users when sensors have identified an incident. Besides dedicated smart home and enterprise security solutions providers, telcos are increasingly seeking opportunities in the video surveillance space which, along with wider managed service adoption, improved camera resolutions, and higher video signal quality, accounts for an ever-increasing volume of fixed and mobile data traffic.

Evaluating enterprise use cases for VR and AR

VR also has a potential role in a number of industry verticals, where it will provide enhancements to existing video communications solutions. The health sector in particular can benefit from VR applications that may be used for various functions, such as surgery simulation, remote surgery, and tele-medicine. Telcos are likely to start incorporating VR and AR components into the video communications solutions they already offer to enterprise and industry customers. The success of VR and AR in the enterprise will be highly dependent on the strength of the ecosystem developed in support of the hardware, and 360-degree cameras are one example of this ecosystem starting to build out. We anticipate that enterprise is far more likely to embrace the less-bandwidth-intensive AR apps than the consumer segment, which will gravitate significantly toward VR gaming scenarios.

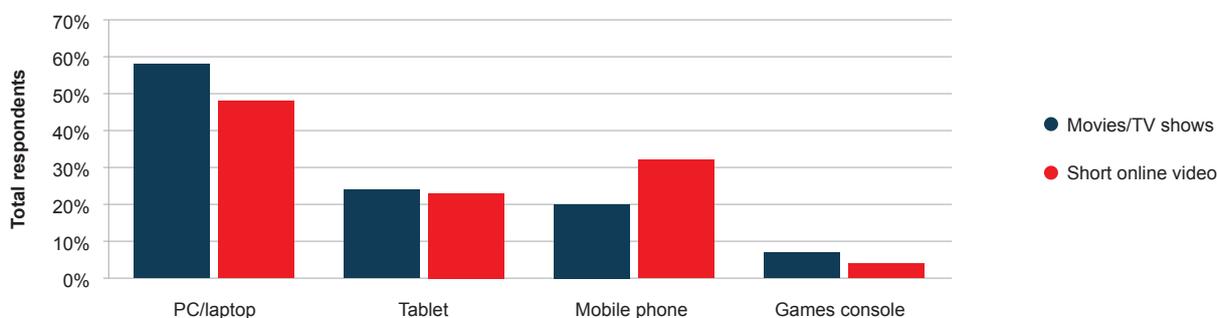
One of the most widely used M2M applications is surveillance video deployed as part of managed security solutions.

How consumer video consumption is evolving

Global online video usage

Ovum's Consumer Insights Survey of broadband users, conducted in October 2015 with 16,000 respondents across 11 country markets, was designed to explore how consumers use their broadband services. The survey data shows that consumption of online video across multiple devices is already highly prevalent among a substantial proportion of the addressable audience, with more than two-thirds of connected consumers regularly watching video content on Internet-enabled devices.

Figure 8: Regular consumption of online video content types, split by device type (global)



Source: Ovum; N = 16,016

We expect that, as mobile broadband proliferates more quickly and widely than fixed broadband, and as the viewing preferences of emerging generations become more prevalent, short-form video consumption will

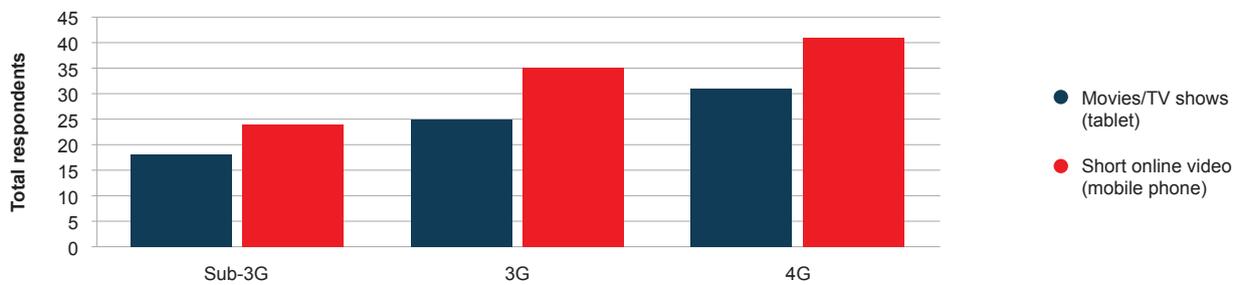
be increasingly commonplace. Also, as the quality and variety of short-form content improves, we anticipate that it will occupy an increasingly significant share of video data traffic.

Examining the mobile video consumer

Better user experiences drive demand for content and services while broadband access speeds (as well as availability of appropriate devices) impacts content consumption levels. Figure 9 below highlights the impact of mobile network connectivity on video consumption, with the likelihood of regular mobile usage increasing sharply in line with connection speeds. While short-form consumption is already relatively high among those with sub-3G connections, there is a marked upturn in adoption among 3G and 4G users, clearly highlighting the correlation between frequency of video consumption and improved user experience.

Short-form video consumption will be increasingly commonplace. Also, as the quality and variety of short-form content improves, we anticipate that it will occupy an increasingly significant share of video data traffic.

Figure 9: Short- and long-form video consumption, split by mobile broadband connection type

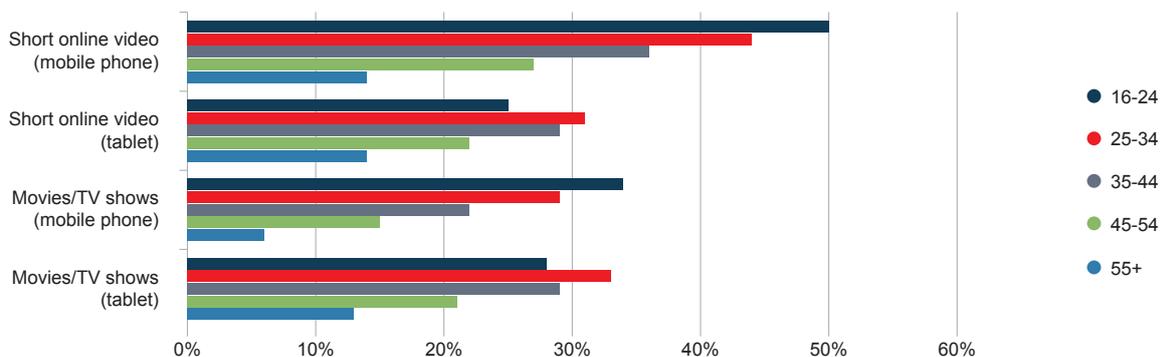


Source: Ovum; N = 16,016

Although PC/laptop remains the most common means of accessing online video across the age spectrum, usage of portable and mobile devices for watching video is significantly more prevalent among younger age groups. Also, because of the wider accessibility and affordability of handsets, those within the younger demographic segments are much more likely to consume short-form video on their mobile phones than via tablets.

In our view, tablet adoption will reach a plateau, while handsets will continue to proliferate as younger generations emerge. Short-form video is already evolving rapidly beyond low-quality, user-generated clips to encompass a wide range of professionally (and semi-professionally) produced content. Device vendors, content producers, telcos, and distributors will all continue to push the development of short-form video as it becomes an increasingly important part of the connected entertainment value chain.

Figure 10: Regular mobile / portable consumption of online video, split by age group

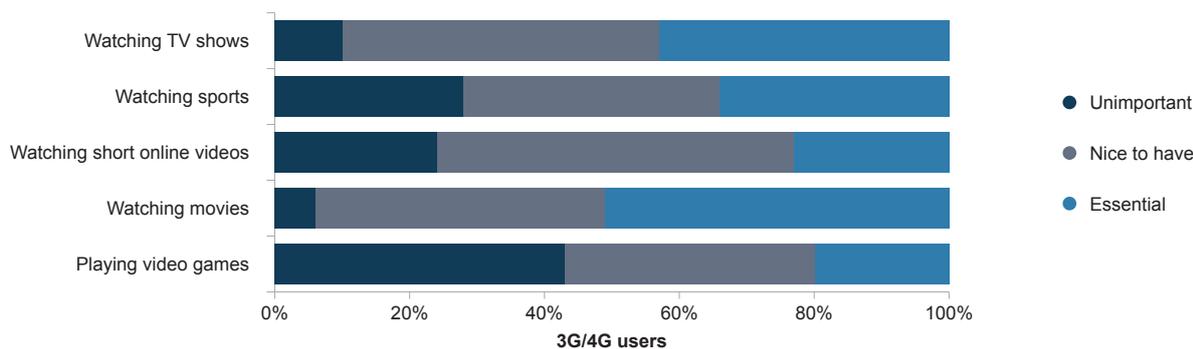


Source: Ovum; N = 16,016

Entertainment categories such as TV shows, movies, and video games are of far more interest to those with 3G and 4G mobile connection speeds than those without. In particular, just over half of 3G/4G users cite watching movies online as an essential activity, compared to just 35% among those with sub-3G connections or no mobile service. As high-speed mobile broadband continues to permeate the mass market, operators are becoming better placed to pitch higher-value mobile/portable video content services to an increasingly entertainment-hungry audience.

Short-form video is already evolving rapidly beyond low-quality, user-generated clips to encompass a wide range of professionally (and semi-professionally) produced content.

Figure 11: Video consumption priorities for mobile users



Source: Ovum; N = 11,784

As high-speed mobile broadband continues to permeate the mass market, operators are becoming better placed to pitch higher-value mobile/portable video content services to an increasingly entertainment-hungry audience.

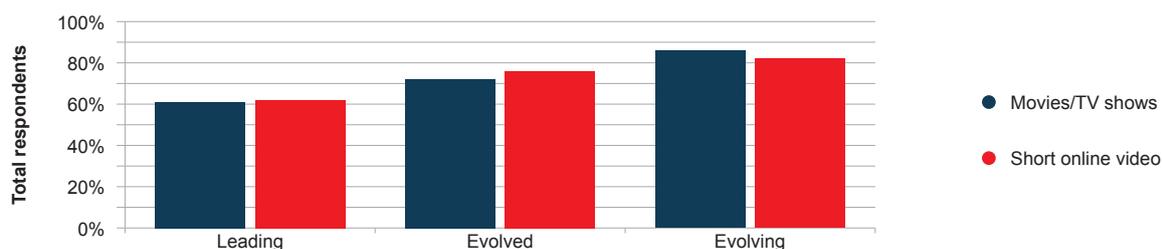
Regional variations in online video consumption

Segmenting the country samples into distinct market categories according to their relative level of development enables us to highlight how variations in adoption are impacted by connectivity. This section of our survey analysis splits the sample into three segments according to the 4G share of total mobile subscriptions in each country. The country segmentation is:

- Leading: 40% 4G penetration of mobile subscriptions or higher
- Evolved: 11–39% 4G penetration of mobile subscriptions
- Evolving: 10% or lower 4G penetration of mobile subscriptions.

Figure 12 below highlights regular (at least monthly) usage of long-form and short online video among consumers with a home broadband connection in each of the three regional market groupings.

Figure 12: Regular online video consumption among leading, evolved, and evolving markets



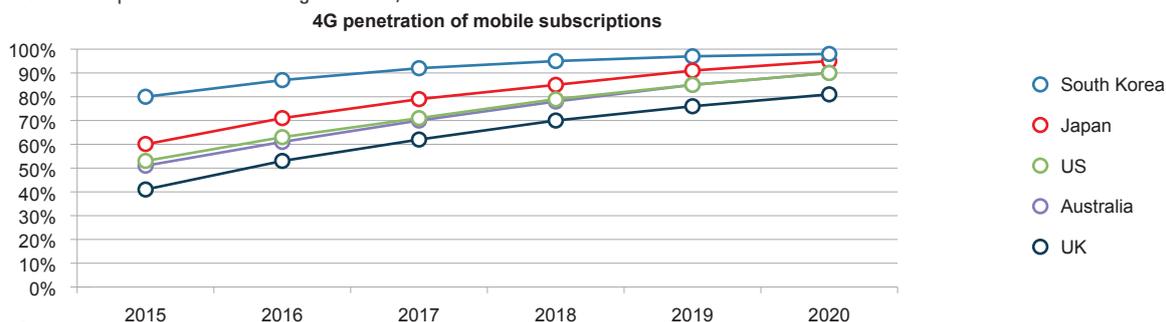
Source: Ovum; N = 16,016

In Figures 13, 14, and 15 we have presented current and projected penetration of 4G as a proportion of total mobile subscriptions alongside present adoption levels to highlight the importance of the mobile opportunity for video service expansion across the various country market types.

Leading markets: A mature broadband user base

One of the most striking initial observations is the apparently lower adoption of online video in leading markets compared to those in the evolved and evolving categories. It should be noted that mobile broadband penetration is already well established in leading markets and as such, serves a wide spectrum of the population. In leading markets, the broadband population is much wider than in less developed countries, with a large proportion of late adopters and casual users.

Figure 13: 4G adoption within leading markets, 2015–20



Source: Ovum

By 2020, we expect 4K UHD penetration to reach well over half of TV homes in most leading markets, paving the way

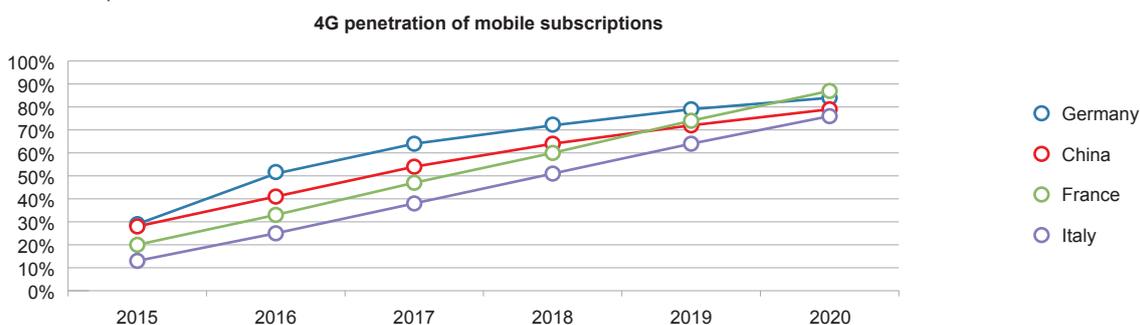
Mobile broadband penetration is already well established in leading markets and as such, serves a wide spectrum of the population.

for the development of higher-bandwidth video services across traditional broadcast, pay-TV, and converged delivery platforms. We have seen that the majority of 4K services launched so far are in countries from our leading markets category. It is in these markets – as well as the evolved China market – where advanced telco infrastructure will play a key role in the development and evolution of UHD services.

Evolved markets: Higher online video adoption and a growing mobile viewership

The trends for evolved markets highlighted in Figure 14 reveal a massive growth opportunity for CSPs – both OTT and network-based – to roll out video services and for telcos to facilitate the availability of equipment and infrastructure to support those services. China in particular, already showing extremely high uptake among its broadband-connected survey sample, entered the leading market category during 2015 based on 4G penetration levels, which are projected to exceed 80% of mobile subscriptions (1.2 billion) within this huge market by 2020.

Figure 14: 4G adoption within evolved markets, 2015–20



Source: Ovum

Evolving markets: Primed for mobile video expansion

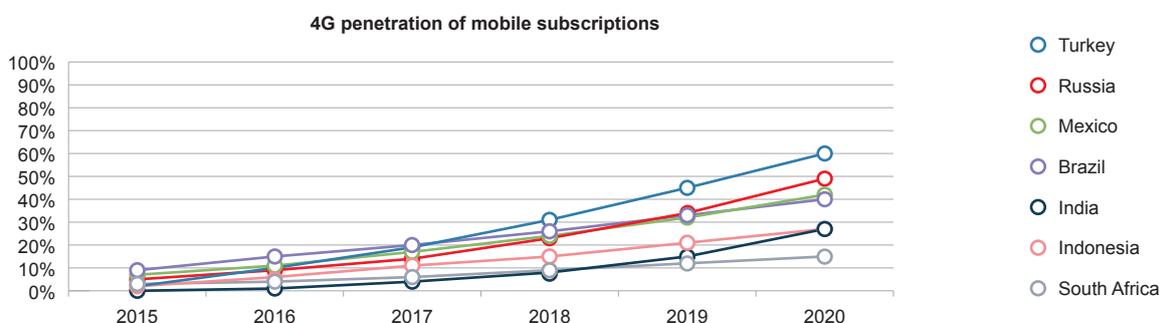
The countries in our survey sample represent around three-quarters of the projected global 4G user base in 2020 and the biggest growth area will be in the currently low-penetrated, evolving markets. In these significantly less developed markets, the broadband user base is skewed toward early adopters. Here, interesting applications tend to become widely available before broadband access, with many users purchasing broadband specifically for using video services.

While adoption of mobile video among broadband-connected consumers in evolving markets is currently highest among

our three categories, these levels will gradually decrease in line with projected exponential growth in 4G penetration as well as the associated maturity of broadband and content service uptake. Yet this decline will be offset by higher adoption of mobile broadband relative to fixed.

By 2020, we expect 4K UHD penetration to reach well over half of TV homes in most leading markets, paving the way for the development of higher-bandwidth video services across traditional broadcast, pay-TV, and converged delivery platforms.

Figure 15: 4G adoption within evolving markets, 2015–20



Source: Ovum

These evolving markets host a huge potential user base and hence substantial latent opportunities for mobile broadband and content service development. While the already relatively evolved Chinese market contains the biggest single 4G population, the evolving markets of Asia will provide a further 4G base (and hence an addressable mobile video base) of nearly 1 billion by 2020. The fixed infrastructure limitations that characterize most evolving (and some evolved) markets mean that most users access the Internet via mobile networks. Given such conditions, it follows that mobile video is likely to grow much faster and more expansively than traditional pay TV over cable, satellite, or IPTV.

Around three-quarters of the projected global 4G user base in 2020 and the biggest growth area will be in the currently low-penetrated, evolving markets.

Examining the video opportunities for network operators

Products and services

Currently, the greater part of video data is attributable to third-party or non-operator-provided video services. As video distribution increasingly shifts to IP – across both managed and unmanaged IP networks – network operators have an opportunity to grow their proprietary video operations. Given the current period of evolution and the unique qualities of network operators, we believe that network operators must act quickly and aggressively to assert themselves in fast-changing video value chains. Of course, that process has already started with many operators.

The original telco video initiative: IPTV

Managed delivery of linear broadcast and video-on-demand services to a set-top box at a fixed location via a private or closed (fixed) broadband network is the distribution method underpinning the vast majority of

telco-initiated pay-TV operations over DSL and fiber access networks. IPTV services have been deployed by more than 50 telcos worldwide with several, including Belgacom, China Telecom, Orange (France), PCCW, Portugal Telecom, and Singtel, having achieved leadership positions in their respective pay-TV subscriber markets. As an extension and value-add to the core broadband access business, IPTV is a central pillar of the classic telco multiplay expansion strategy.

On average, the world's IPTV operators are servicing 2.1 revenue-generating units (RGUs) per individual customer.

Mobile video is likely to grow much faster and more expansively than traditional pay TV over cable, satellite, or IPTV.

OTT video: From Netflix to network operator

More than 90% of the 70 operators included in Ovum's 2H15 Telco TV Benchmark are delivering some form of streaming video. At least two-thirds provide multiscreen access to pay-TV content while a further third offer a Netflix-type SVoD option and almost a quarter distribute third-party OTT video services to their subscribers.

A steadily growing number of telco TV operators are integrating third-party OTT services into their own branded STB environment. Such partnerships provide an opportunity for telcos to receive compensation for promoting and delivering content and services from adjacent players. Ovum's Operator-OTT Partnerships Tracker counts more than 20 telcos that integrate third-party OTT video services (primarily Netflix) into their STBs, with some also further enhancing the value position with integrated carrier billing. On the mobile streaming side, Ovum's tracker lists dozens of MNO bundling partnerships whereby the operator promotes and drives usage of third-party OTT video services (often through promotional subscription subsidies), while monetizing their effort through premium tariff packaging. In the US, T-Mobile claims that its customers' video usage has doubled since the launch of its Binge On entertainment streaming service, which now accounts for 70% of all its network's video usage.

Apart from the now almost ubiquitous proprietary multiscreen / TV Everywhere enhancements and a handful of standalone OTT SVoD products, telcos' much larger role in video streaming is that of an enabler to third-party content service providers, whose video services are delivered via network operators' wireline and cellular broadband data infrastructure.

The growing importance of video communications: Calling, chatting, and conferencing

Although RCS is one option for telcos exploring provision of video calling, another has emerged – WebRTC. An open source project, WebRTC seeks to create a framework, protocols, and an API for real-time voice, video, and data communications delivered through a WebRTC-enabled browser via multiple device types and multiple network technologies. It is viewed by mobile operators and the wider industry as being far more accessible than RCS, evident in the number of trials and deployments of the technology.

On average, the world's IPTV operators are servicing 2.1 revenue-generating units (RGUs) per individual customer.

Deployments include Telenor's Appear.in service, which is being used by consumers and enterprises, and Telefonica's TokBox, which has a number of enterprise users. Also, many enterprises are working with vendors or independently to deploy WebRTC-based services within their companies, mostly in the customer-care function because the typical use case is videoconferencing or video chat. Telco and enterprise interest in and use of WebRTC-based video conferencing and chat services will persist, with the number of deployed use cases growing. Meanwhile, the WebRTC standard will stabilize to the point that it starts to satisfy telco requirements for carrier-grade infrastructure. Hosted or cloud-based videoconferencing services are now offered by a wide range of providers. These include a number of telco operators, such as AT&T, BT,

Orange Business, Telefonica, T-Systems, and many others. AT&T also includes fixed, desktop, and mobile videoconferencing endpoints as part of its Virtual Care tele-health solution.

Enterprise video streaming use cases

Besides dedicated online video platform (OVP) providers such as Brightcove, Kaltura, and Ooyala, a number of telcos have entered the corporate video space, including AT&T, whose Video Management Services portfolio provides an end-to-end enterprise video platform solution that encompasses video capture, transcoding, content management, and delivery. Among the enterprise functions supported are: employee training; company-wide town hall meetings; external live webcasts; corporate social video; video blogging; employee video uploading / sharing; customer interaction, advertising, and feedback; and investor relations updates and addresses.

Security and surveillance

For several years, CCTV has been used extensively among enterprises and is increasingly present within managed home security solutions. Both telcos and specialist security technology and service providers are involved in the implementation of home and enterprise video surveillance. Examples in the enterprise sector include BT's Redcare suite of CCTV products and services as well as Verizon's IP-based Intelligent Video solution, which forms part of a wider Smart Cities portfolio. BT reports that its Redcare video networks support four out of five public authority control rooms, to which it connects more than 44,000 CCTV channels, carrying in excess of half a million video images per second – which is more than 43 billion daily. Telco opportunities in video surveillance go beyond the traditional anti-theft, site security function with which the application is typically associated. Enterprises can achieve management efficiencies and manpower rationalization by using video surveillance solutions for remote supervision, for example. Surveillance can be extended to provide in-home security-type functions such as baby monitoring as well as assisting with the care of young children, elderly people, and pets. Demand is expanding from the private sector and into the arena of public services such as information management for government agencies as well as scenarios such as the live monitoring of traffic, food-catering activities, or events at tourist attractions.

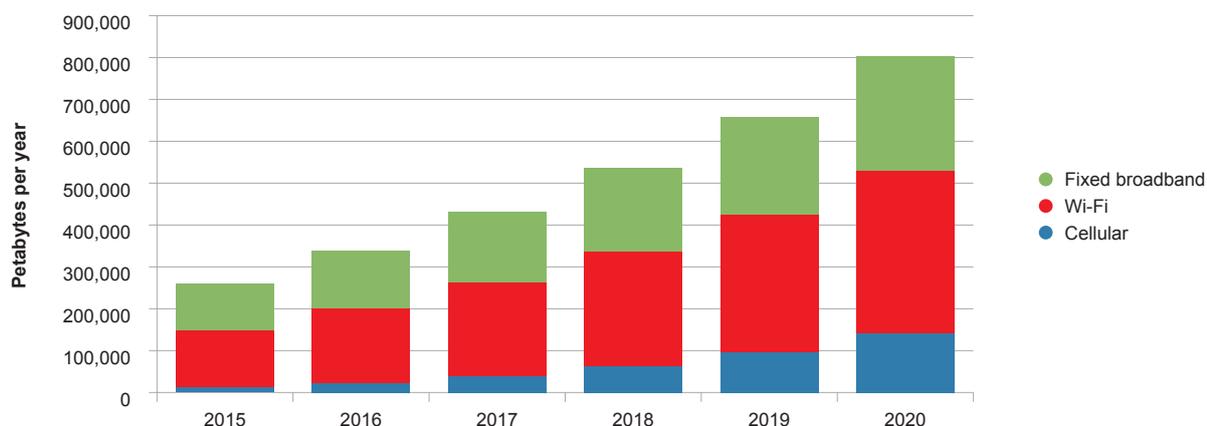
Digital signage

Machine-to-machine (M2M) digital signage is another application in which video plays an ever-increasing role, particularly for the retail sector. Telcos may either provide the network infrastructure to support their customers' digital signage needs in partnership with third-party specialists, or alternatively they may also offer end-to-end turnkey signage solutions. Several incumbent telcos, including AT&T, BT, Deutsche Telekom, Telefonica, and Verizon, are all involved in the provision of M2M digital signage solutions to retailers and other enterprise clients. These products include both in-store video and large outdoor displays. Telefonica's end-to-end offering, for example, encompasses equipment supply and installation, after-sales support, and management with further options for content design, content management, and basic communications network access. The telco provides digital signage via its On the Spot business unit, whose portfolio includes in-store media services and audiovisual services for enterprises. In addition, On the Spot's activities include the implementation and management of digital out-of-home (DOOH) advertising networks across seven countries where it services a total of 26,000 digital signage points.

The fastest data growth is on cellular networks

Video currently accounts for just over three-quarters of all global unmanaged video traffic and will continue to do so for decades to come. Global unmanaged video traffic is set to grow at a CAGR of 25%, tripling in the five years to 2020 to just over 800,000 petabytes per year. The fastest-growing video traffic category will be cellular, which will grow at a 65% CAGR to exceed 142,000 petabytes, with its share of the global total rising from 5% in 2015 to 18% in 2020. Wi-Fi will continue to underpin the largest share of traffic, accounting for around half of the total throughout the forecast period and growing at a CAGR of 24%.

Figure 16: Global video traffic forecast over unmanaged IP networks, 2013–20



Source: Ovum

Telco network advantages

As well as significant obligations, network ownership also gives telcos a natural advantage in video. While the networks must be maintained and strengthened regardless of the telcos' business strategy, the networks also enable telcos to enjoy a number of unique qualities that offer significant competitive benefits.

- In their respective country markets, telcos typically control the largest paid service customer segments, including individuals, families, and enterprises. This enables them to more effectively target a variety of video products to a wide base of end users.
- Telcos can leverage extensive offline marketing channels for video service expansion and maintenance. They also have the opportunity to integrate online and offline marketing assets.
- Many telcos – multinational operators in particular – have substantial capital resources that provide opportunities for enhancing their video market presence through acquisition.
- Telcos are well positioned to create optimal end-to-end user experiences by integrating diverse technology assets (including cloud, CDN, network infrastructure, big data, devices, etc.) into unified platforms.

New technologies and their impact on video delivery

Video is fueling the telecoms value chain, pushing operator investments into more capacity (and other QoE elements) while also bringing those operators new data subscribers and propelling vendors to improve equipment, devices, and network performance. Ovum's forecast illustrates that video in 4G cellular networks accounted for 89% of total video traffic across all cellular networks during 2015.

The two main technical challenges operators face is the sheer amount of video that is going through their networks and the fact that this is now beginning to be encrypted. Operators have traditionally managed video through optimization, transcoding, caching, and making sure that bandwidth was not wasted in their networks. Encryption limits their ability to manage video, as traffic passes through their networks in tunnels, on which they have no visibility.

Video is fueling the telecoms value chain, pushing operator investments into more capacity (and other QoE elements) while also bringing those operators new data subscribers and propelling vendors to improve equipment, devices, and network performance.

Regardless of these challenges, operators are now transforming to become more agile players, evolving into experience enablers rather than simple access providers.

Several technologies will be introduced in telecom networks in the coming years that will enhance their video delivery capabilities. The following sections discuss the most prominent of these technologies.

The two main technical challenges operators face is the sheer amount of video that is going through their networks and the fact that this is now beginning to be encrypted.

The importance of speed: The advent of ultra-broadband networks

The telecoms industry is now discussing the next stage of its evolution – one that will bring faster, more resilient, and agile networks to market. Fixed and mobile broadband networks are evolving in a linear fashion, where higher speeds and more advanced technologies are being deployed while at the same time, new architectures are being defined, which will eventually change the entire nature of their deployment, operation, and management. Ultra-broadband networks are the most important technology outlined in this section for video delivery since access is a major bottleneck in the end-to-end video delivery system.

Regardless of these challenges, operators are now transforming to become more agile players, evolving into experience enablers rather than simple access providers.

Improving video quality over cellular: The impact of 5G rollout

3G enabled the static, graphic online experience. 4G is driving mobile VoD usage with better video quality, faster downloads, and larger data allowances. 5G potentially enables an improved live streaming experience as well as the possibility of UHD resolution over cellular networks.

Video is one of the key drivers for extreme mobile broadband and the need to guarantee a positive user experience throughout the network, not only at the center of the cell. Several use cases for 5G focus on video delivery, whether this is streaming or broadcast, and are major reasons for advancing the evolution of mobile networks. 5G introduces several new use cases for mobile networks, including ones that provide ultra-low-latency (<1ms) connectivity to end users. This will allow operators to offer AR or VR services, since they will be controlling the last mile and the processing capabilities at the edge of the network.

5G potentially enables an improved live streaming experience as well as the possibility of UHD resolution over cellular networks.

Fixed broadband continues to evolve

Fixed broadband networks are certainly not lacking in activity compared with mobile. FTTx and gigabit passive optical networks (GPON) are fueling new deployments for faster speeds while G.fast is extending the life of copper networks and enabling higher speeds through the same networks that operate today.

Both mobile and fixed networks are largely driven by the requirements of video, since there is no other service category today – or expected in the near future – that requires a higher amount of bandwidth. Experience has also shown that when there is sufficient bandwidth available, end users create and consume significantly more video.

More capacity in current networks will mean that higher resolutions of content will be offered. Several operators are now discussing 8K video delivery in fixed broadband and 4K in mobile.

Several operators are now discussing 8K video delivery in fixed broadband and 4K in mobile.

This trend will only accelerate and will be strengthened by the emergence of VR, AR, and other immersive applications. Whether operators will be successful in monetizing these new technologies through video remains to be seen, but it will certainly be their intention to do so.

Cloud computing

In the telecoms domain, cloud computing is expected to change the way networks are deployed, managed, and monetized. Sooner or later, data centers will house network infrastructure, and telecom networks will evolve to become distributed clouds. In the context of video, telcos will be able to manage any type of content much more effectively, because they will have massive processing resources available to them. Several vendors are starting to utilize the power of cloud for video optimization today, a trend that will only accelerate with the deployment of cloud computing in telecoms. Cloud computing is considered a key pillar for the delivery of video through telecom networks. Creating, hosting, caching, and transferring video content are all achieved with cloud computing resources.

New video technologies and use cases are emerging every day, while the industry seeks new ways to optimize the delivery of video. Video compression, optimization, and streaming technologies are being developed and aim to enhance and facilitate the efficient delivery of video through telecom networks.

For example, a recent development is mobile edge computing (MEC), a technology that aims to optimize encrypted video by utilizing computing resources at the edge of the network (for example, at the cellular base station or the customer premises equipment). Although encrypted video is nearly impossible to optimize, MEC – and similar initiatives – mean that there may be more opportunities for monetization and partnerships available to telcos in the future.

Cloud computing in telecom networks will redefine how processing resources are utilized and has already redefined how video optimization is performed in the operator domain. Despite the growth of encrypted video and overall decline in telco-based video optimization, cloud computing is nevertheless considered a major component for video applications.

Cloud computing is considered a key pillar for the delivery of video through telecom networks. Creating, hosting, caching, and transferring video content are all achieved with cloud computing resources.

Telco OS

One of the latest trends following the deployment of cloud computing, SDN, and NFV in telecom networks is telco operating systems (OS), where the whole network is effectively controlled by software (in its broad definition, which includes BSS, OSS, big data, etc.).

The IT domain has already experienced similar trends, where the likes of Google, Facebook, and Amazon run their whole networks by utilizing commoditized hardware and advanced software that they have created themselves. This will inevitably happen in the telecoms domain too, with initiatives such as ONOS now developing telecoms operating systems.

Although it is quite early to be discussing telco OS in the context of video, theoretically any application will be made more efficient by using software. Operators will have a chance to offer more granular services that are deployed and changed in real time and will have a much wider range of opportunities for monetization that will extend well beyond access services alone. This is valid in video services too, where operators may find new ways to offer services, e.g. offer video clips or an immersive experience for fans during a large sports events.

Operators will have a chance to offer more granular services that are deployed and changed in real time and will have a much wider range of opportunities for monetization that will extend well beyond access services alone.

Operator and technology vendor perspectives on the video opportunities afforded by technical and network innovation

Another commonly identified opportunity was that arising from the industry's increasingly enlightened approach to utilizing the huge amounts of data their operations produce. Currently data is used by the TV industry in a relatively primitive manner. Companies must evolve their infrastructure such that it enables the collection, analysis, and data-driven decision-making that big data enables.

The volume and quality of data generated by viewers' usage of STBs offers huge potential that TV service providers are only just starting to really use. One vendor saw significant opportunities in "helping customers manage the complexity of data, formats, and the size and kinds of files" inherent in operating a video business.

The key near-term opportunities arising from big data for the video ecosystem were identified as:

- Helping keep content acquisition costs in check. This tends to be the largest expenditure for most video and TV businesses, hence improving investment decision-making can make a significant impact on opex. Detailed usage data can help reveal what content is the most effective and where a distributor might be overpaying.
- Targeting ads: TV is increasingly targeting ads at particular viewer demographics, adding dynamic ad insertion in live broadcasts to its capabilities. The data necessary to target TV audiences currently comes from subscriber data, STB usage data, and third-party credit and marketing databases.
- Improving subscriber management and reducing churn by using data: Companies can build profiles of customers who are likely to churn or trade down their video services e.g., unsubscribing to a premium movie channel. These profiles are based on the data patterns observed from subscribers who have churned, which are subsequently used to identify likely candidates for churning. In this situation the service provider can be proactive and contact the subscriber, perhaps offering a free period to encourage usage or a discount.
- Improving the user experience, not just in terms of what happens on screen but the entire subscriber relationship with the company.

Looking ahead: Recommendations for video-centric network operators

Long-term strategy: Big video as a basic service

Since big video is already identified as a strategic imperative by several telcos, it is crucial that they get the implementation of their video strategies right. The overall implementation of a big video strategy can be divided into three steps:

- Large-scale development and segmentation of the user base into individual, family, and enterprise customer groupings is an essential requirement. Strong existing market positions in bundled services provide the potential to offer evolved bundles to augment existing bundles with new services, such as an aggregated online or mobile video and TV entertainment proposition.
- At the same time telcos should focus on ensuring customer loyalty and retention. Meanwhile, as part of this process, telcos can explore how to transform video business models from paying for services to paying for a differentiated, high-quality video user experience.
- Most importantly, telcos should attempt to drive integration across the entire video industry ecosystem to maximize the market opportunities for all participants in the video distribution value chain.

Transforming data networks to video-centric networks

Operators own and operate the broadband networks third-party OTT and mobile video services need to reach users: as well as working directly with third parties to improve QoS, operators can help third parties build audiences by bundling or cross-marketing services to their own subscriber bases. From this perspective, telcos should embark on the construction of their own network transformation as soon as possible, allowing for future networks that are both more suitable for video transmission and more readily adaptable to a variety of business scenarios.

Companies must evolve their infrastructure such that it enables the collection, analysis, and data-driven decision-making that big data enables.

Innovating data monetization

Operators have the potential to innovate data monetization, reducing the potential for bill shock and to drive higher levels of video consumption over cellular networks in particular. The entire question of how data and entertainment can be monetized in an integrated fashion is still being settled. Currently data is charged separately from entertainment, which is a constraint on usage and potentially network investment. If the commercial needs of network owners and entertainment providers can be more closely aligned, there is potential to accelerate the entire business of online video distribution. In the short term, network owners can facilitate commercial arrangements between third-party entertainment providers and either themselves or other distributors in ways that focus on the value of the entertainment proposition while obfuscating the cost of data in bundled consumer propositions.

Driving video ecosystem cooperation – an operator imperative

The cooperation of all companies in the video ecosystem is critical in delivering not just any video experience but a high-quality, differentiated video experience that can justify higher ARPU levels. Given the complexity and number of players required to deliver video streams via IP, proactive cooperation is critical in ensuring that the video user experience fulfills user expectations. In addition, a high degree of clarity regarding where bottlenecks lie and whose responsibility it is to address those bottlenecks is required.

These attributes enable operators to differentiate from competitors on quality of user experience and to offer opportunities for ecosystem collaboration with third-party content and communications video service providers looking to ensure reliable delivery of their products and the long-term growth of their user bases.

