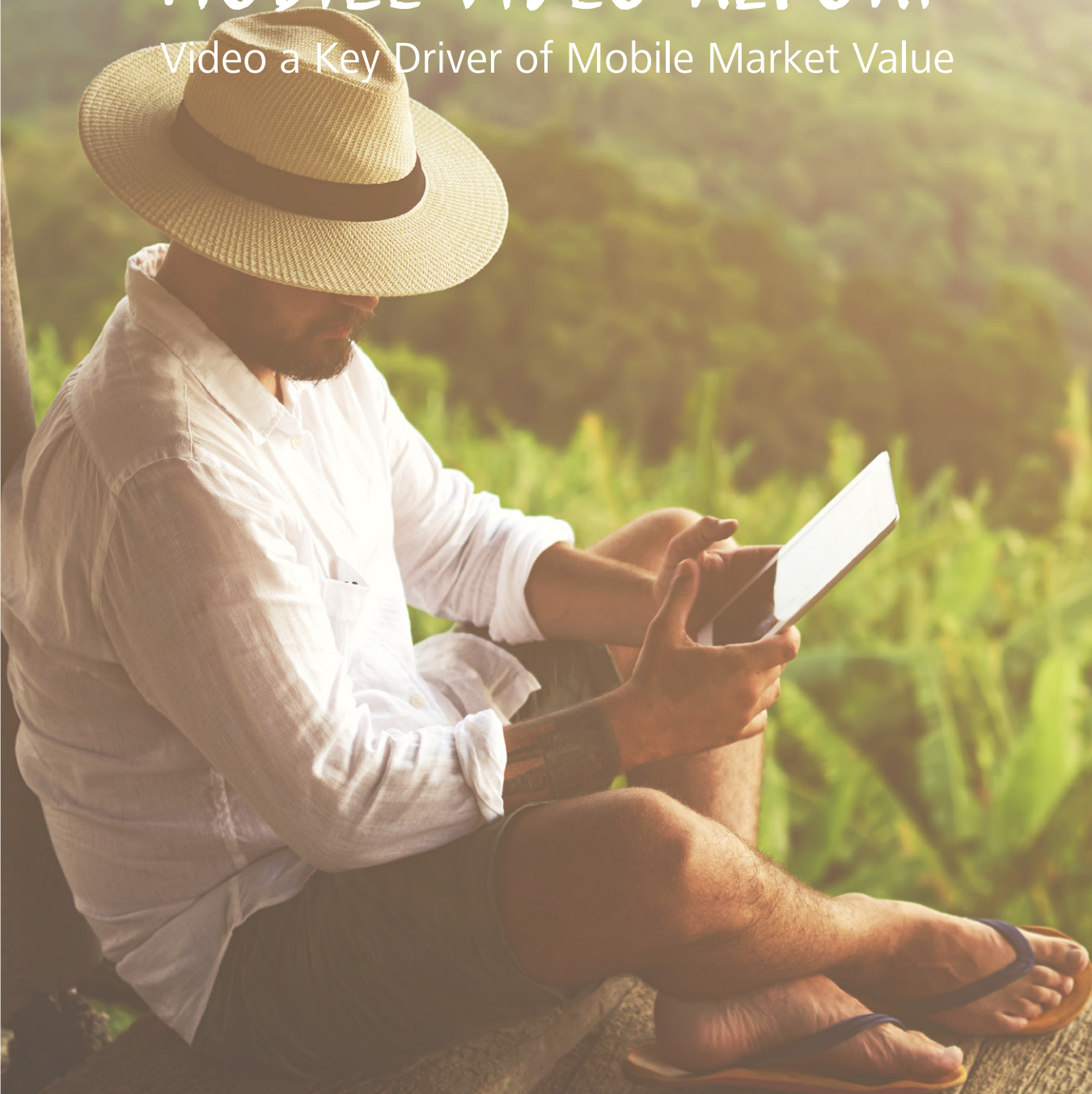




MOBILE VIDEO REPORT

Video a Key Driver of Mobile Market Value



A Huawei Mobile Video
Insight Report Series
June 2016

Partner with
STRATEGY ANALYTICS
Research, Expertise, and Analytics



047-499532
003910
83743
416 392
017-97318
03629411799
817920 5128

047-499532
003910
83743
416 392
017-97318
03629411799
817920 5128

047-499345732

84749373

047499345732

43849f5nv948

0937594jd ms7

73890483738

73890483738

73890483738



047-499532
003910
83743
416 392
017-97318
03629411799
817920 5128

047-499532
003910
83743
416 392
017-97318
03629411799
817920 5128



Contents

1	○ Executive Summary	02
2	○ Mobile Video Dominates Data Traffic	04
	2.1 Mature Markets Drive Mobile Video to Dominate Worldwide Mobile Data Traffic	05
	2.2 Mobile Video Evolution: Social, Live Streaming & Immersive	09
3	○ Mobile Video as a Basic Service	12
	3.1 Behavioral, Technical, and Ecosystem Drivers for Mobile Video	12
	3.2 Mobile Video is Not a Supplementary Service: It is now a Basic Mobile Service Expectation	28
4	○ Operator Strategies to Stimulate Mobile Video Traffic	30
	4.1 Case Studies on Successful Mobile Video Services	30
	4.2 Key Recommendations for Operators to Exploit End-User Mobile Video Expectations	34



1

EXECUTIVE SUMMARY

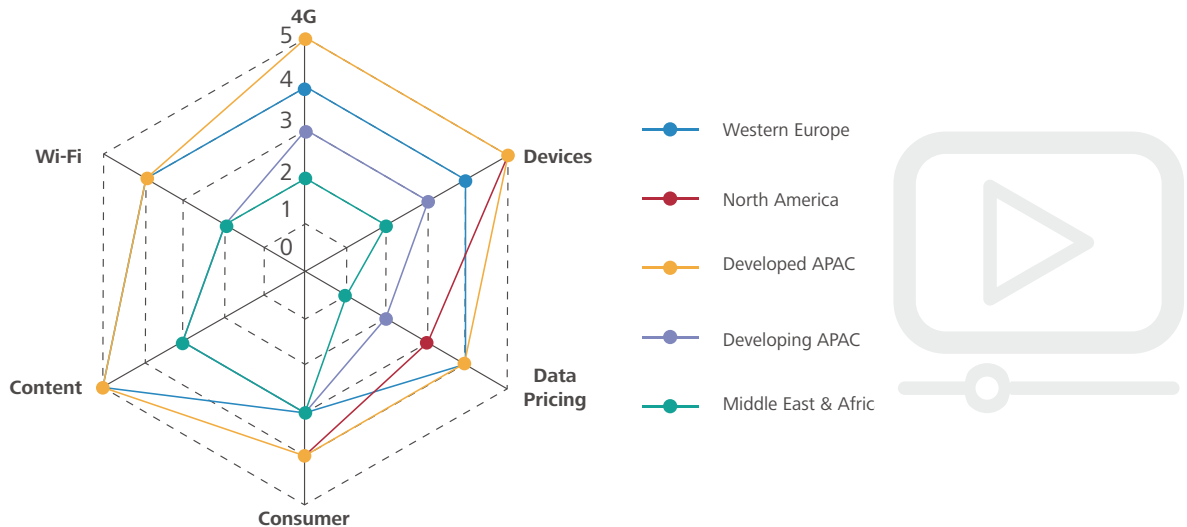
Mobile video is the dominant source of data traffic on mobile networks in a growing number of countries, making a significant contribution to data revenue growth in both developed and developing regions. Mobile is a key part of today's anytime, anywhere patterns of video consumption, with service evolution through social video, live streaming and immersive 360° or VR/AR video boosting user demand and capacity needs. Video is also becoming increasingly important to users on other dimensions; as a means of communication, a source of information and security, or a means of self-expression.

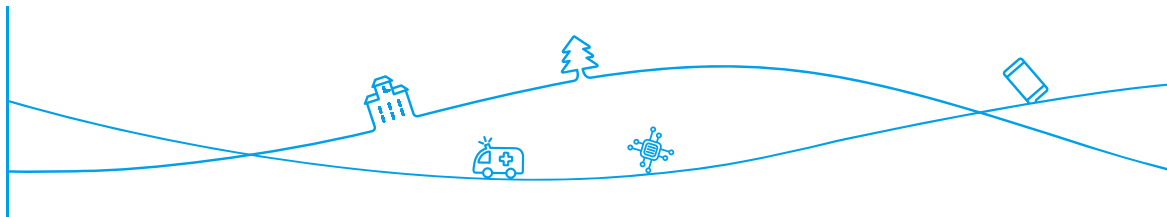
In many markets, there is a strong alignment of the key drivers of growth in mobile video adoption, across a range of behavioral, technical, and ecosystem factors, contributing to mobile video traffic growing by more than 10-fold over the next five years, according to forecast by Huawei. Plotting these demand-side and supply-side drivers on to a mobile video maturity scorecard, we can see that developing markets have yet to satisfy sufficient criteria for significant mobile video adoption, and that there is also still much that developed markets can do to exploit the revenue opportunity offered by mobile video traffic growth.

These drivers are combining to make video a basic mobile service expectation for a growing number of customers and operators need to embrace this market reality. Focusing on the video maturity scorecard, strategies for video revenue stimulation should include:

- Addressing affordability with a range of video-centric plans that can address both existing consumer demand for video services, and also casual users or new-to-video users with smaller bite-size snacking options;
- Optimizing quality of experience with 4G network upgrades and video optimization techniques which, using metrics like the video mean opinion score (U-vMOS), are targeted to ensure technology investments are targeting in locations, on platforms, or for user segments where the returns will be highest;
- Partnering with strong video service providers or, in highly mobile-centric market environments (particularly in developing countries), developing their own video services which fill gaps in OTT or social video options.

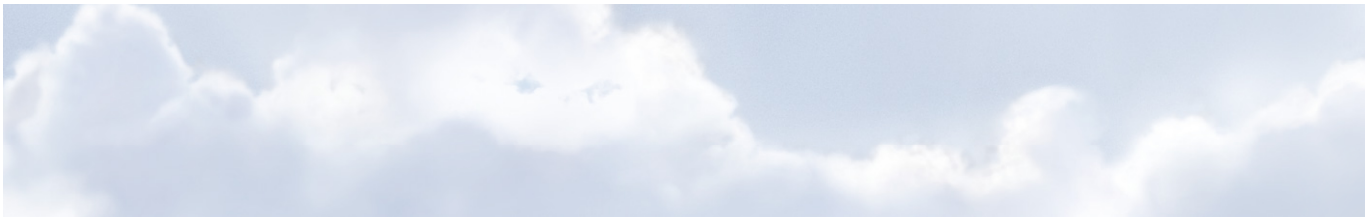
Exhibit 1: Mobile Video Maturity Scorecard by Region





It is forecast that the population of mobile video users will double to more than 2 Billion by 2021. Driving overall traffic loads on mobile networks, these users are key to data revenue growth for mobile operators. The experience of leading video-centric operators, such as T-Mobile USA and LG Uplus, shows there is much value to be gained by optimising strategies to target these users.





MOBILE VIDEO DOMINATES DATA TRAFFIC

MOBILE VIDEO IS BECOMING IMPORTANT NOT ONLY AS A FORM OF ENTERTAINMENT, BUT ALSO AS A MEANS OF COMMUNICATION, A SOURCE OF INFORMATION, A MEANS OF SELF-EXPRESSION AND A SOURCE OF SECURITY AND REMOTE-MONITORING.

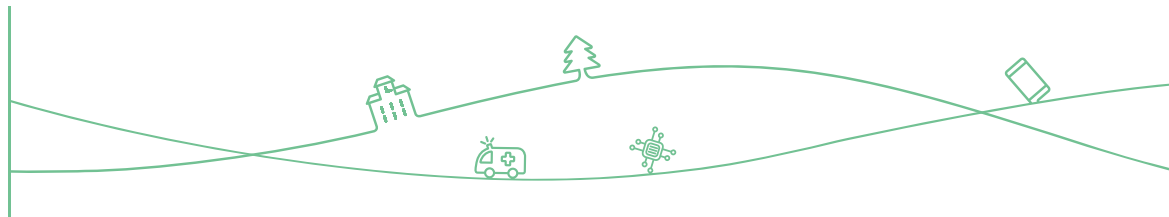
Mobile video has rapidly emerged as the dominant source of data traffic on mobile networks, now accounting for more than 50% of traffic in more developed markets and key to rapid data traffic growth rates. Mobile is a key part of today's anytime, anywhere patterns of video consumption, extending the opportunities for users to binge watch box sets, avoid missing that must-watch TV episode or live event, or just casually filling up a short period of down-time catching up on social video. Video as a passive yet engaging entertainment form is central to the traffic volumes, dictating operator network investments and strategies to optimize end-to-end quality of experience, though it is becoming important to users, and so network operators, on other dimensions:

- As a means of **communication**: the work of Skype and, perhaps more significantly for mobile services, Apple's Facetime to democratize video chat services has helped lift active video chat users on smartphones to over 400 million by the end of 2015. As mobile video chat and group video chat gain in popularity for consumers and enterprise use, it impacts the need for latency, speed and capacity for both downstream and upstream access.
- As a source of **information**: YouTube has also emerged as an important source for many when looking for information online. The search engine is a common starting point, though YouTube features heavily as a destination site for current affairs, product reviews and hands-on demonstrations, and how-to videos covering everything from fixing a leaking tap to solving PC software problems. Text versions of all of these exist online, though many prefer video. These evolving behavioral patterns and preferences apply not only to developed markets, where screen choices allow the user to bring the video solution to the

problem, but also to emerging markets, where lower adult literacy rates make video a more attractive medium for information assimilation.

- As a means of **self-expression**: video sharing apps used to share video clips or live user-generated video, such as Instagram, musical.ly and Periscope impact not only the need for downstream access but also upload capacity in networks.
- As a source of **security and remote-monitoring**: for consumers, video offers peace of mind in applications such as baby monitors or home security, building on the existing role of mobile and remote video in vertical and IOT applications. We are seeing growing use of video surveillance for both security and safety, from policing crime to monitoring lone worker safety, and for improving operational efficiencies, from industrial workflows to transport systems and the navigation of remote-controlled or autonomous vehicles such as drones or cars.





2.1 Mature Markets Drive Mobile Video to Dominate Worldwide Mobile Data Traffic

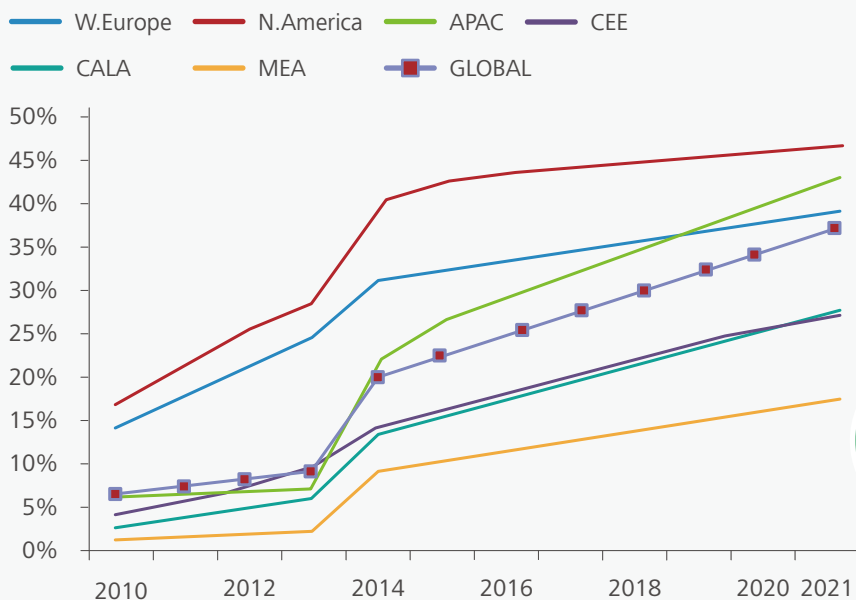


THE POPULATION OF MOBILE VIDEO USERS WILL DOUBLE TO MORE THAN 2 BILLION BY 2021, AT 36% OF PENETRATION.

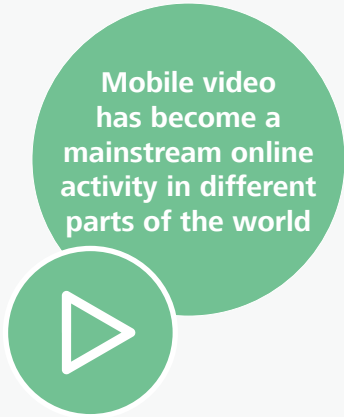
Mobile video has become a mainstream online activity by mobile consumers in different parts of the world. 1 Billion people, or close to a quarter of the world's mobile handset users are watching mobile videos. Strategy Analytics forecasts the population of mobile video users will double

to more than 2 Billion by 2021, at 36% of penetration. North America will continue to lead penetration while APAC's penetration level will overtake that of Western Europe in 2019. See Exhibit 2.

Exhibit 2: Global & Regional Mobile Video Penetration 2010-2021



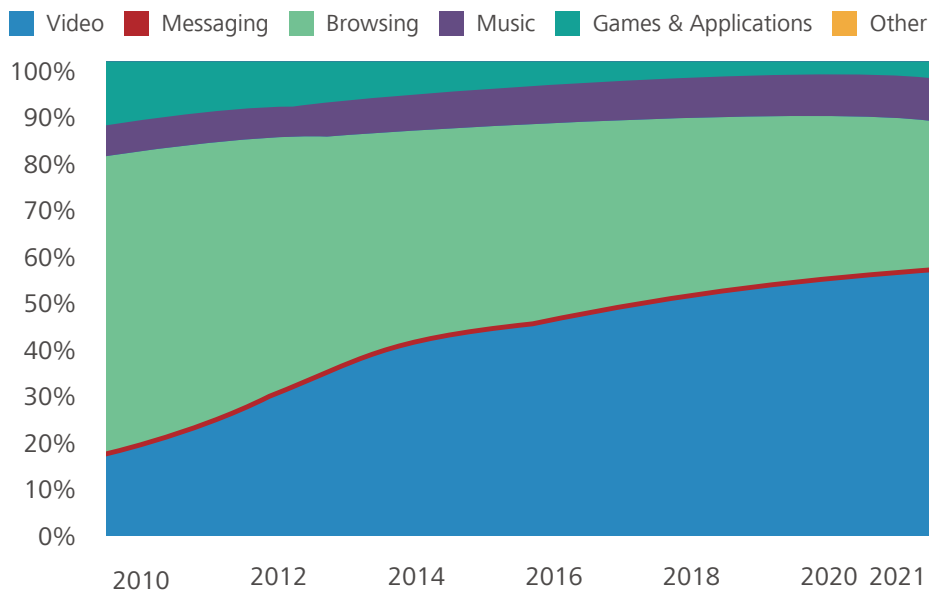
Source: Strategy Analytics, 2016



The fast growing mobile video population and increased video consumption on individual bases have been driving mobile data consumption through an exponential growth in recent years, and has shown no sign of slowdown. According to the research by Strategy Analytics, in 2010, the application that consumed most data by a mobile user was mobile browsing, accounting for 61% of the total data volume including both cellular and Wi-Fi. By 2014, video had become the single largest data consumption application type, accounting for 43% of the total globally. Strategy Analytics forecasts video will account for more than 58% of the global total mobile data traffic by 2021. Exhibit 3 shows the contribution to the total mobile data consumption by different application types.



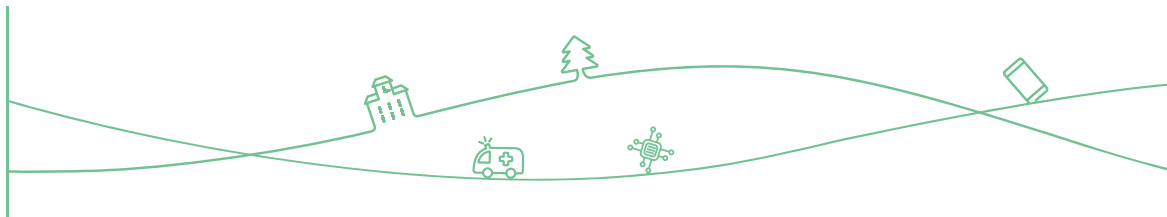
Exhibit 3: Mobile Data Consumption by Application Types, 2010-2021



Video will account for more than **58%** of the global total mobile data traffic by 2021

Source: Strategy Analytics, 2015





The significance of video in the data generated varies from market to market, with the proportion much higher in mature markets like North America, Western Europe, advanced APAC, than emerging markets like Middle East & Africa, Latin America and developing APAC.

- In the US market, Verizon Wireless reported 50% of its data traffic is video;
- In the UK, the operator EE reported that 52% of mobile data going through its network has been generated by video, while its competitor Vodafone sees video responsible for 51% of its data traffic in the UK, and just under 50% of the total mobile data traffic across its European operations.

This is not only a North American and Western European, or mature market, phenomenon.

- In Asia Pacific, 40% of China Mobile's data traffic was serving videos, while Korea's telecom regulator MSIP reported that 57% of all data traffic going through the country's public mobile networks was generated by video.



IN SAUDI ARABIA, 55% OF DATA GOING THROUGH STC NETWORKS AND 50% GOING THROUGH MOBILY NETWORKS IS STREAMING MEDIA, WITH THE MAJORITY BEING VIDEO

- In Saudi Arabia, 55% of data going through STC networks and 50% going through Mobyly networks is streaming media, with the majority being video. In the Gulf Countries in general, 36% of mobile data going through LTE networks is generated by streaming media, up from 31% of data going through 3G networks.
- In Russia, MTS may have reported that 36% of the traffic through its network was video, but it does not include the video traffic inside social networks, which generated 23% of the total data traffic.
- The way of classifying data consumption types is also helping to hide the significance of video in Telecom Italia's networks, which reported social networks generated 25% of the total mobile traffic, in addition to the 35% of traffic generated by media streaming.



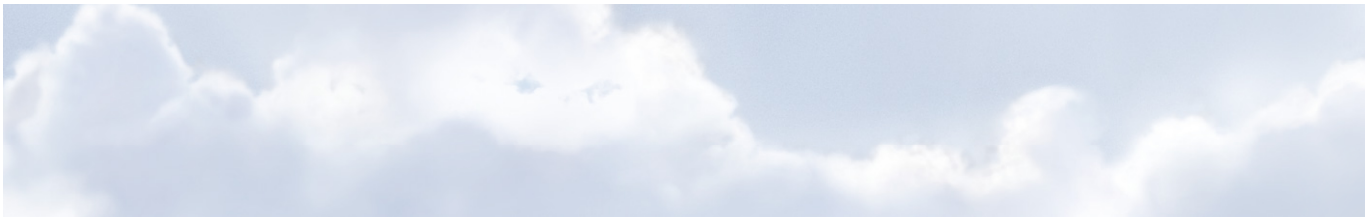
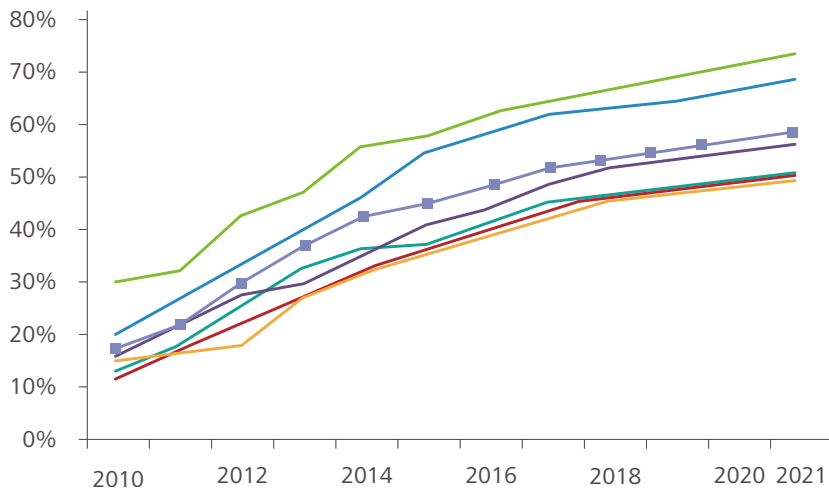


Exhibit 4 forecasts the share of data generated by mobile video in different regions.

Exhibit 4: Video as % of total mobile data by region

Western Europe Central Eastern Europe North America Central & Latin America
Asia Pacific Middle East & Africa Global Traffic




Mature markets such as NORTH AMERICA, WESTERN EUROPE, ADVANCED APAC have much higher video traffic.

Source: Strategy Analytics, 2015

On individual bases, video apps, either to stream on-demand video or to play back locally stored videos, rank among the most engaged apps by mobile users, according to Strategy Analytics' telemetry platform

AppOptix. Exhibit 5 shows the average minutes spent on the top apps per user per day, the red columns being video apps.



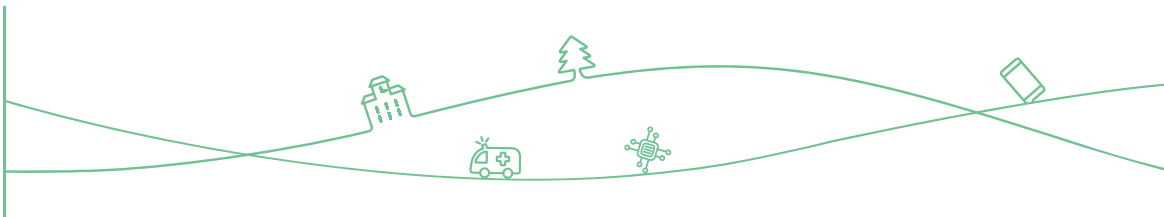
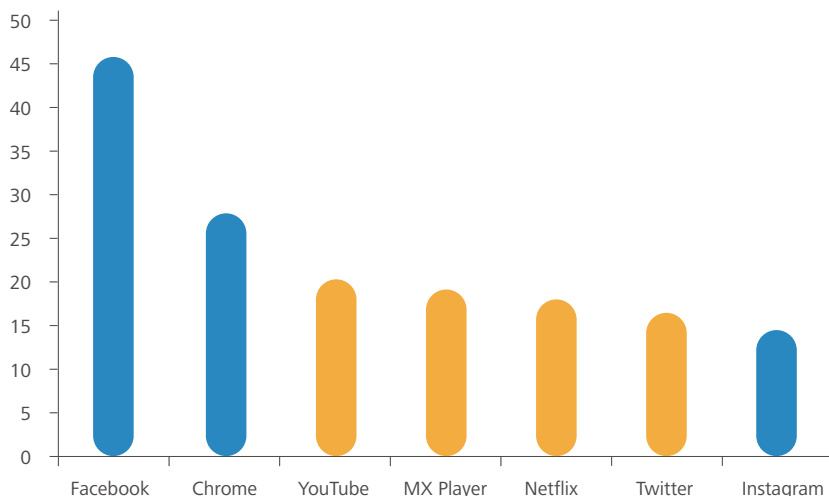


Exhibit 5: Minutes Spent on Leading Apps per User per Day, Q1 2016, USA

Mobile Video Market Value by Business Model

- Facebook
- Chrome
- YouTube
- MX Player
- Netflix
- Twitter
- Instagram



Users spend most of time on video related apps either in social media or streaming media.

Source: Strategy Analytics, AppOptix, 2016

Users may spend more time in social networks, but it is the mobile video apps that consume the most data, not to mention the traffic on social networks also has large amount being video. According to the data published in 2015 by the network software company Sandvine,

YouTube alone was consuming around 20% of the total mobile data in all regions, with the lowest in Asia Pacific (17.6%) and the highest in Latin America (24.6%).

2.2 Mobile Video Evolution: Social, Live Streaming & Immersive

Services like Netflix, YouTube and the BBC’s iPlayer continue to draw mobile viewing. YouTube reported that the average length per mobile viewing session has grown by 50% from a year ago to about 40 minutes. Netflix reported in 2015 that on average a customer would watch 1.8 hours Netflix program per day. According to data from Strategy Analytics’ consumer telemetry platform AppOptix, 20 minutes Netflix watching was happening on mobile per day, and consumers also spent 15 minutes watching Hulu on their smartphones per day. In the case of the BBC iPlayer, consistently around 40% of all requests for the BBC’s TV programs, both live and catch-up, come from mobile phones and tablets.

Meanwhile, more innovative video consumption behaviors are becoming mainstream, in particular video in social networks. After it enabled video autoplay, Facebook

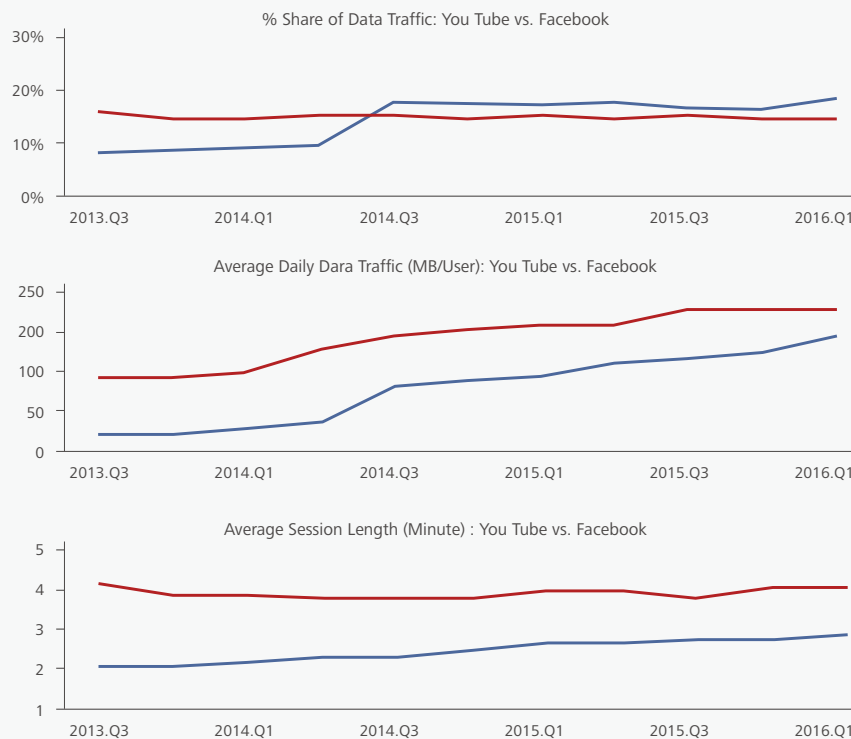
HIGHER AVERAGE USAGE AND LONGER SESSION LENGTH ON FACEBOOK BOTH POINT TO THE CENTRAL ROLE OF VIDEO IN DELIVERING COMPELLING CONTENT OVER THE PLATFORM

reported that its 1.04 billion daily active users (DAUs), including 934 million on mobile, watch 8 billion videos a day, which is equal to 7.7 videos per user per day. Snapchat, which is available on mobile only, has 100 million DAUs but also reports 8 billion daily video views, which equals to 80 videos watched per user per day.

Data from Strategy Analytics' AppOptix smartphone telemetry research highlights the increased use of video services and growth in average data usage levels from social network services fuelled by video service adoption. Exhibit 6 profiles YouTube and Facebook usage patterns for Android smartphone users in the US, with the launch of autoplay resulting in Facebook overtaking YouTube as a source of video traffic (see top chart in Exhibit 6). With YouTube mobile traffic 2.5x higher than Facebook traffic in 2013 (middle chart), the growth in video consumption on Facebook, facilitated by autoplay, saw it overtake

YouTube by late 2014, due to the larger base on active Facebook users despite their still-lower average usage levels, with average daily usage levels for users of both apps converging further into 2016. Higher average usage and longer session length on Facebook both point to the central role of video in delivering compelling content over the platform.

Exhibit 6: YouTube vs. Facebook Smartphone Usage Profiles



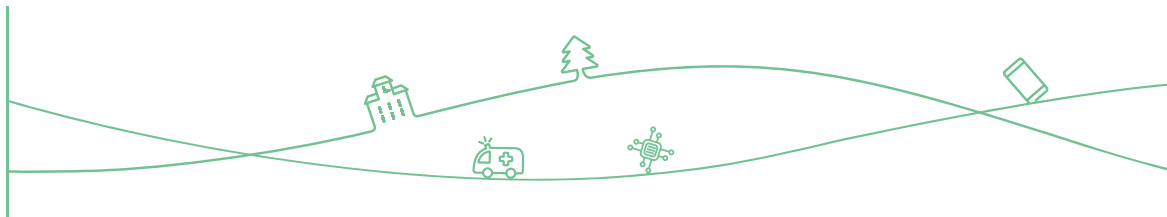
Facebook fueled by video service adoption is overtaking Youtube as a source of video traffic.

Source: Strategy Analytics, AppOptix, 2016

Another new trend that is driving further growth of mobile video consumption is live video streaming. Twitter's Periscope, the market leader in live video streaming, announced that it has carried out 200 million live broadcasts in one year, and the total amount of time users spend per day watching these live broadcasts from its Android and iOS apps equals to 110 years. Facebook responded by moving its Facebook Live service out of beta and opened to all users. As a matter of fact, mobile video sharing and viewing inside social media, and its impact on mobile data traffic, is so significant, that

Vodafone has singled it out as a new driver for further data consumption. So far, videos in social networks and live video streaming are all ad-funded with no premium content fee charged to consumers for viewing, and we do not see this model change in the foreseeable future, which means the advertisements transmitted are creating even more data traffic.

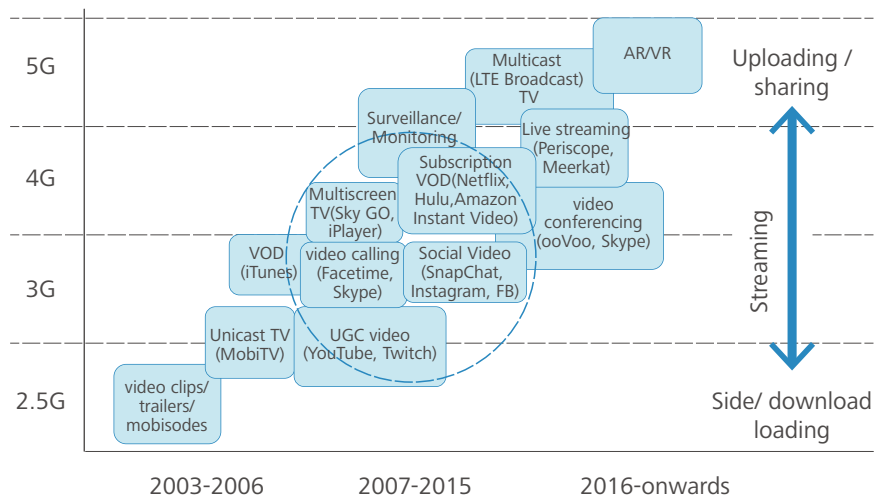
Among the upcoming trends, we see Virtual Reality (VR) capable of creating a disruption in the mobile video domain, spurred in part by the investments by industry




heavy weights like Microsoft and Facebook. VR will place even further pressure on mobile networks, because in order to achieve the effects desired, e.g. the immersive 360-degree viewing experience, even larger amounts of data need to be transmitted than normal video streaming. For example, a 5-minute standard definition VR clip by the New York Times would consume 150MB data, almost doubling the amount of data to stream a Netflix video of similar definition.

As a matter of fact, the significance, hence the demand on networks, of mobile video is so high that, while consumers may spend a similar amount of time online, different use cases can have vastly different implications on data traffic. Exhibit 7 charts the growth in availability of video content type over time as network speeds have improved to support higher bandwidth services, highlighting how improving network performance will unlock higher bandwidth video service opportunities.

Exhibit 7: Video Content Growth on Mobile Networks



improving network performance will unlock higher bandwidth video service opportunities such as AR/VR



Source: Strategy Analytics, 2016



3

MOBILE VIDEO AS A BASIC SERVICE

Over 1 billion mobile users, or 23% of the world’s total mobile user base, accessed different kinds of mobile video on their phone in 2015. This penetration rate has more than doubled over the previous two years and will remain on a healthy growth trajectory in the medium term. Strong growth in smartphone ownership, combined with the rising penetration of users with access to high-bandwidth 4G or Wi-Fi networks, and the increasing availability of free and ad-supported videos will drive the mobile video users to double to over 2 billion, equating to an estimated 38% of mobile users by 2021.

Video dominates the traffic on mobile networks today, as seen in section 2.1, its 50% share of all mobile data traffic key to unlocking value in the US\$260 billion data access and transport market in 2016.

In the following sections, we highlight the key drivers of future growth in mobile video adoption, covering behavioral, technical, and ecosystem factors, which will contribute to mobile video traffic growing by more than 10-fold over the next five years, according to forecast by Huawei.

3.1 Behavioral, Technical, and Ecosystem Drivers for Mobile Video

3.1.1 Youth Driving Video Adoption: Demand Spans Socio-demographic Boundaries



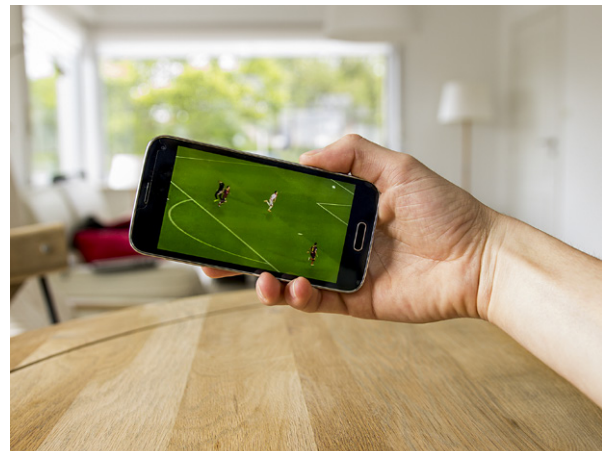
THE YOUTH HAVE HIGHER MOBILE VIDEO ADOPTION. 52% OF 18-29 YEAR OLD SMARTPHONE OWNERS IN US HAD USED THEIR PHONE TO WATCH MOVIES OR TV THROUGH A PAID SUBSCRIPTION SERVICE

Video consumption and sharing fulfils an important human need to be entertained, informed and to connect with others. High bandwidth requirements of the medium, rather than ubiquitous use, have driven video to 50% of traffic on mobile networks. However, with one quarter of users already accessing video on their mobile phones and with improvements in the user experience in terms of both content options and technology enhancements, video is increasingly becoming a basic part of more and more users’ mobile experience.

From a demographic perspective we also find strong differences in video viewing habits by age. Millward Brown found that 16-24 year olds spent more time viewing video on their smartphones than any other platform, with smartphone viewing minutes declining and TV viewing

minutes increasing by age. This is supported by results from research in the UK and USA:

- in the UK, Ofcom found that 45% of the online population in the 16-34 year age group used their smartphone at least once a month to view catch-up TV or video-on-demand content, falling to 26% of 35-44 year olds and just 2% of those over 55 years.
- in the USA, Pew Research found that 52% of 18-29 year old smartphone owners had used their phone to watch movies or TV through a paid subscription service, falling to 36% of 30-49 year olds and 13% of those over 50 years .



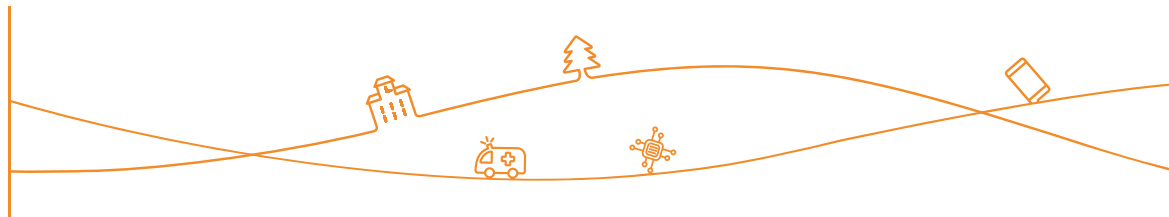
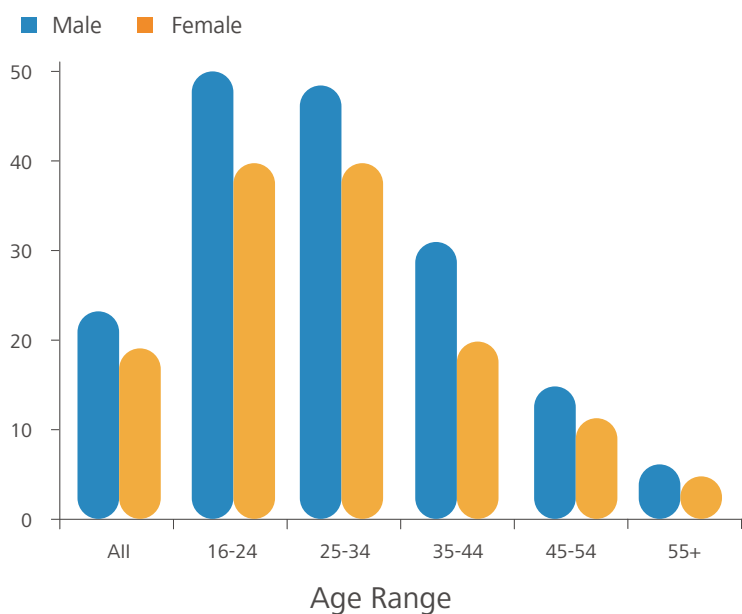


Exhibit 8: Video-on-Demand Smartphone Use by Age & Gender, UK

At Least Monthly Use of Smartphone to Watch Catch-Up & Video-on-Demand Content




Youthful demographic has good video adoption potential

Source: Ofcom, The Communications Market 2015



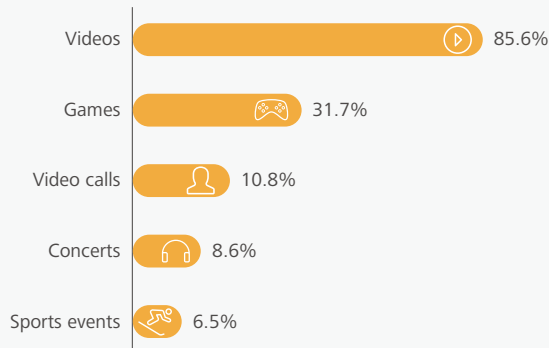
Consumer behavior will also be impacted by the growing availability of immersive video services, which combine HD images with 3D effects, panoramic views and multiple visual angles. Based on a survey conducted by Huawei mLAB in Q1 2016, video content, gaming and video calls are the top use case expectation for immersive video for respondents in the US, Germany, UK, and South Korea, as seen in Exhibit 9.

Within the category of video viewing, Exhibit 10 shows that users from the four countries have rank movies and TV series as the most important immersive video content types. These are the top two content types in

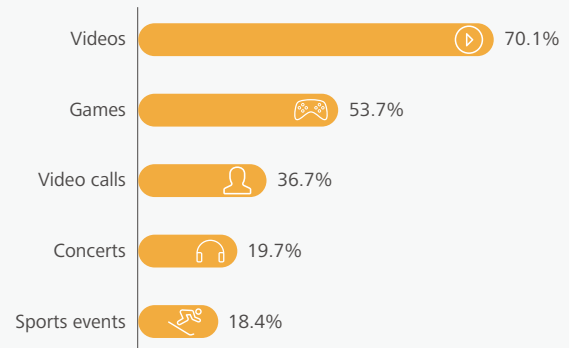
all countries, except the US, where there is a stronger preference for immersive videos for sports events, a more compelling content type than movies. VR was used for the first time to broadcast the NBA opening game held at the end of October 2015. Multiple 180-degree cameras were equipped at the NBA venue to provide broad visual angles, with VR helmet monitors, supported smart phones, and the NextVR application used on the client side. High profile, compelling, content will be key to opening up the opportunities for VR and immersive content and developing user preferences for adopting these higher-bandwidth video solutions.

Exhibit 9: Application Scenarios for Immersive Video

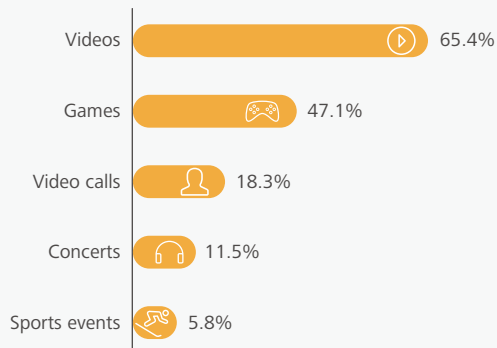
Application Scenarios of Immersive Videos in South Korea



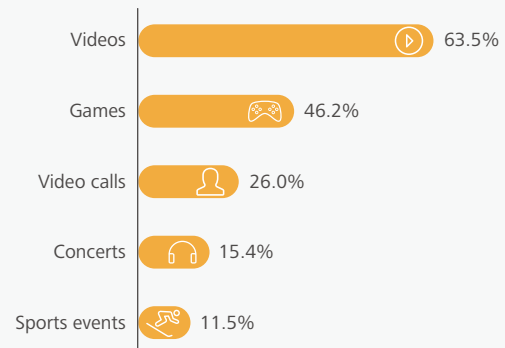
Application Scenarios of Immersive Videos in the US



Application Scenarios of Immersive Videos in Germany



Application Scenarios of Immersive Videos in the UK



Source: Huawei mLAB, 2016

TOP 3 IMMERSIVE VIDEO APPLICATION SCENARIOS: VIEWING VIDEOS, PLAYING GAMES AND MAKING VIDEO CALLS

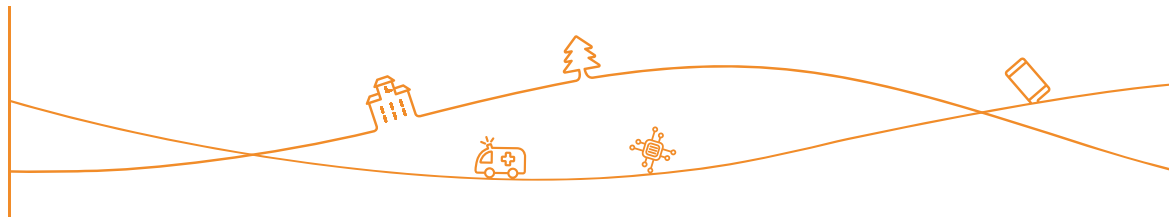
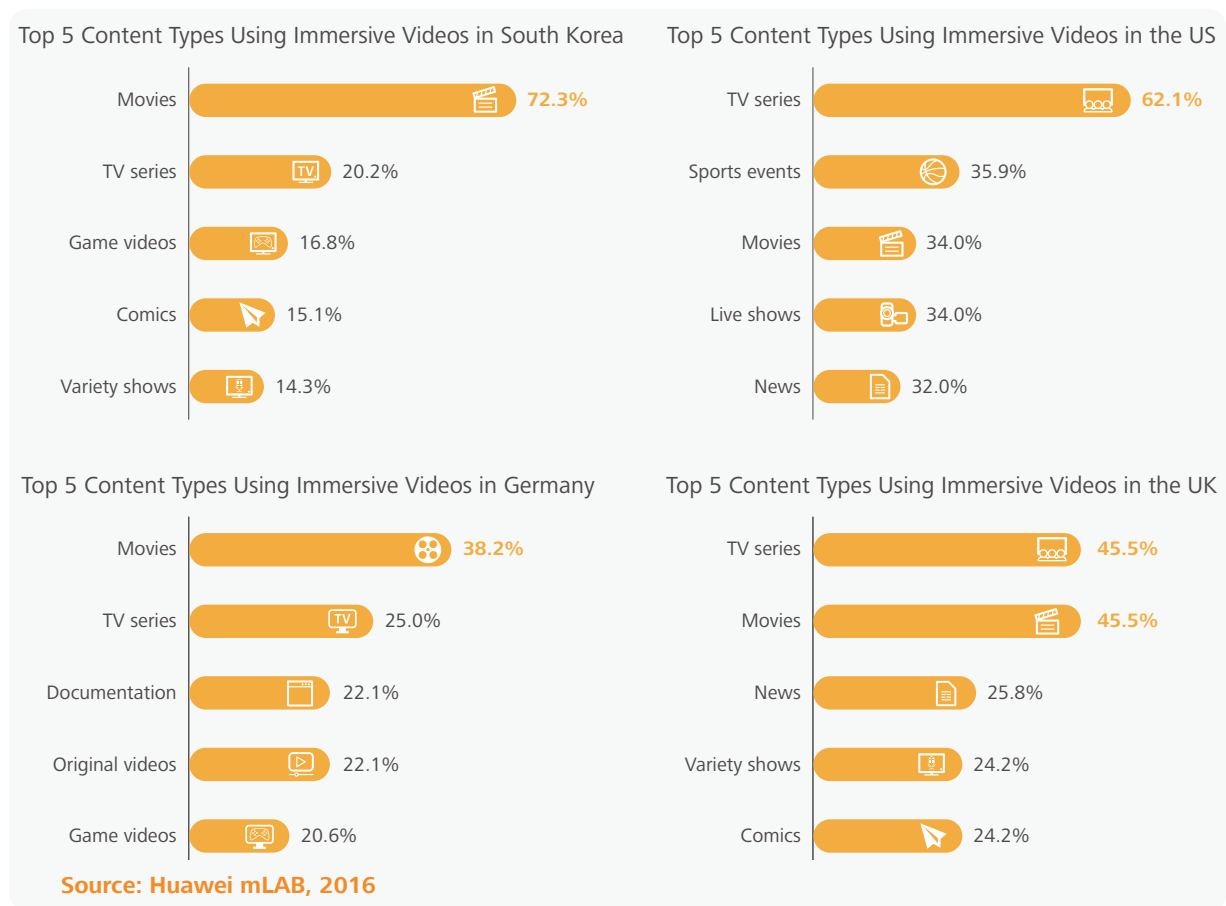


Exhibit 10: Top Immersive Video Content Types



Beyond the pervasiveness of mobile video as a form of entertainment, user behaviour is also evolving to embrace mobile video on other dimensions, most notably as a means of communication and a source of information:

- Pew Research found that 47% of US smartphone owners in 2015 had ever used their phone to participate in video call or chat services, up from 33% in 2013, with Strategy Analytics estimating that Apple’s Facetime in particular has helped to lift active video chat users on smartphones to over 400 million by the end of 2015.



USERS IN THE US PREFER STREAM IMMERSIVE VIDEOS WHEN WATCHING SPORTS EVENTS

- Ofcom found of those who had used YouTube for information gathering 72% felt it was an important source for them, emphasizing how search has moved beyond the need for text-based information or instructions, to video documentaries, video news, or step-by-step video tutorials.



3.1.2 Video Usage Growth Delivered by a Strong Decline in Cost of Mobile Data

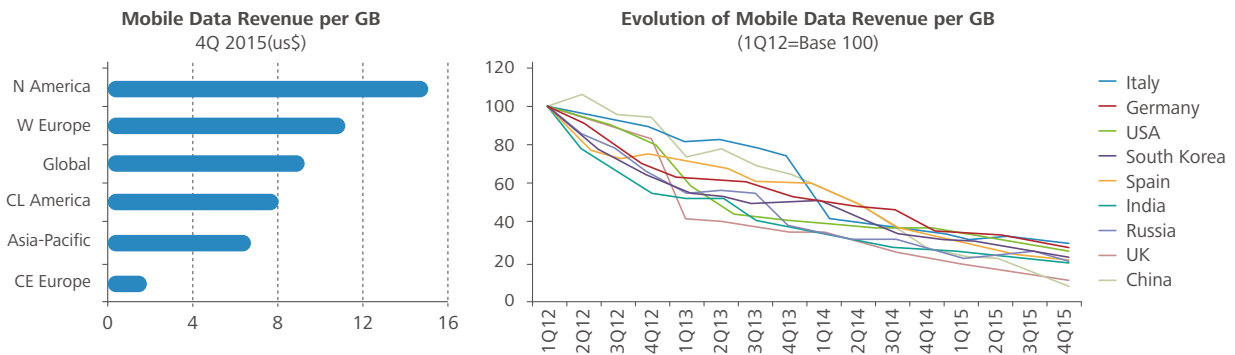


THE FALLING PRICE OF MOBILE DATA HAS BEEN AN IMPORTANT FACTOR IN DRIVING UP MOBILE VIDEO USE, THOUGH AFFORDABILITY IS STILL A CHALLENGE IN MANY INSTANCES

The cost of mobile data has fallen by 50% over the last two years as operators focus on bringing more data users and devices on to their networks and on stimulating spend and usage among existing users—and as cost structures to deliver data have been improved with 4G LTE. Based on data from Strategy Analytics' Wireless Operator Performance Benchmarking database, average revenue per GB has fallen globally from US\$28 in Q4 2012 to US\$13 in

Q4 2014 and US\$9 in Q4 2015. There are strong regional variations ranging from US\$15 per GB in North America to US\$1.20 per GB in Central and Eastern Europe, influenced by Russia, where Megafon's aggressive mobile broadband positioning prices data at just 80 cents per GB. As we can see from the exhibit below, despite these variations, a wide range of countries are seeing the cost of data evolve on very similar paths, down 50-60% over the last three years.

Exhibit 11: Mobile Data Costs: Revenue per GB Evolution



Source: Strategy Analytics, 2016

According to data in Strategy Analytics' Teligen OECD Mobile Voice Price Benchmarking database, over the last three years the average price of data has fallen by 25% for 1GB/month plans and by 32% for 5GB/month plans. These are healthy rates of price decline, albeit slower than the evolution in revenue per GB, which is amplified by users migrating up to larger data plans with lower underlying costs per GB.



Mobile data cost has declined **50-60%** over the last three years

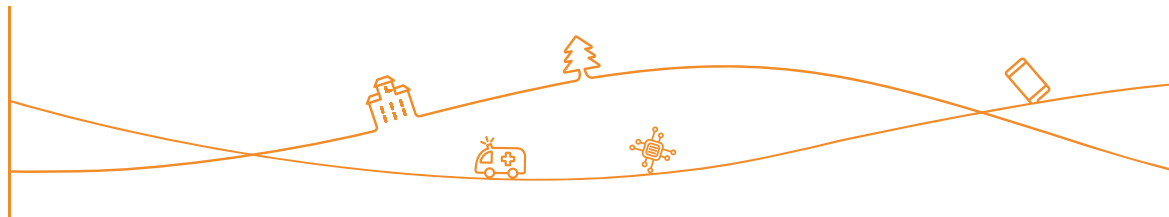
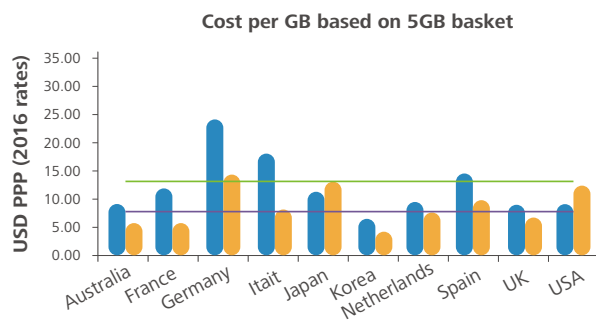
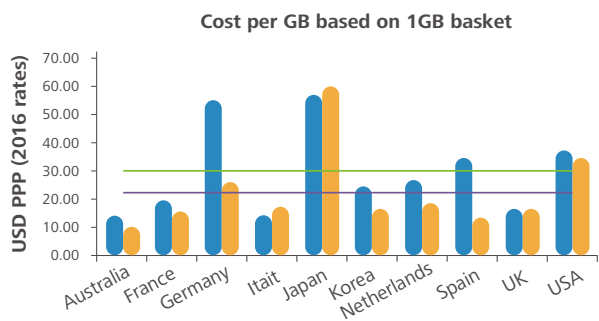


Exhibit 12: Mobile Data Costs: Data Plan Pricing Evolution

■ Feb-13 ■ Feb-16 — Feb-13-average — Feb-16-average



Source: Strategy Analytics' Teligen, 2016

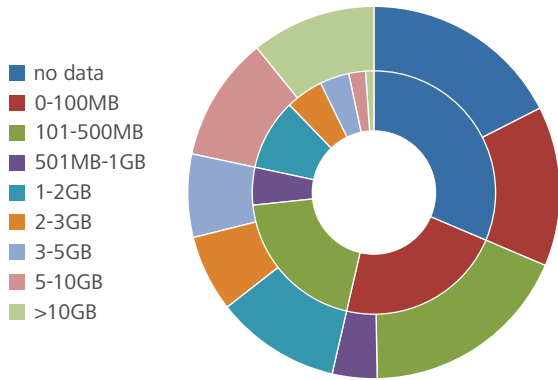
This move to the purchase of larger data plans mirrors the increased focus from operators in pushing these into the market. Strategy Analytics' Teligen database shows that almost three quarters of available handset tariffs in February 2013 offered a base data allocation of 500MB or less. By February 2016, fewer than half of plans were in this volume range and one quarter offered more than 3GB per month. In addition to larger data plans, conducive to video consumption, many operators have tariff plans

bundling in video content or data specifically for video. These are discussed in more detail in Section 3, though include Vodafone's partnership in Europe with Netflix and Sky, T-Mobile USA's BingeOn option, and LG Uplus's VIDEO data plans. These offers, together with the general trend in more affordable mobile data plans, are key in stimulating mobile video use, which itself becomes a major driver of mobile data consumption and expenditure.



Exhibit 13: Distribution of Handset Tariffs by Data Allocation

Mobile Handset Tariff Distribution



InnerCircle:February 2013
Outer Circle:February 2016

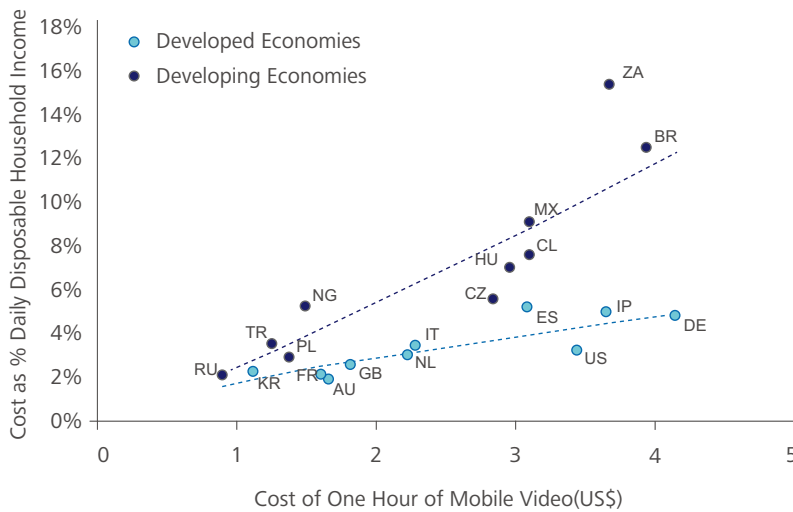
Source:Strategy Analytics'Teligen,216

25% of data plans offered more than 3GB per month in 2016 globally

The falling price of mobile data has been an important factor in driving up mobile video use, though affordability is still a challenge in many instances. In Exhibit 14 we plot the cost of one hour of standard definition mobile video use (consuming 5 MB of data per minute), using the lower per-GB price points from the 5GB data plan profiles above, against the disposable income of households in a range of countries. We

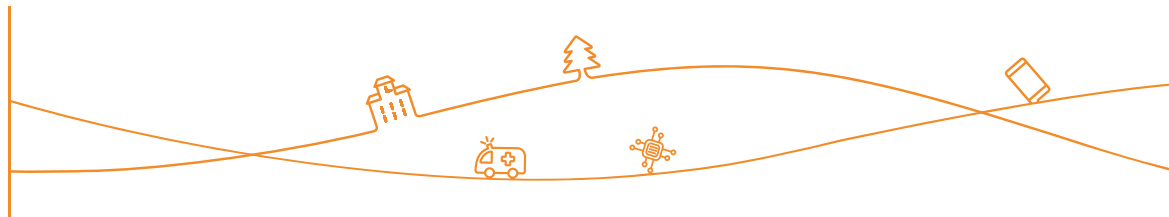
can see that in developed markets the costs are more manageable; one hour of mobile video use typically costs 2-4% of daily household disposable income. In developing markets there is a cluster of countries in this 2-4% range, such as Russia, Turkey and Poland, though the majority of markets show one hour of mobile video costing 6-10% of daily disposable income, rising above 12% in Brazil and South Africa.

Exhibit 14: Cost of Mobile Video as a Proportion of Disposable Income



AFFORDABILITY is still a key barrier to video adoption in developing markets

Source:Strategy Analytics, 216



3.1.3 4G Networks a Catalyst for Improving Quality of Experience for Mobile Video

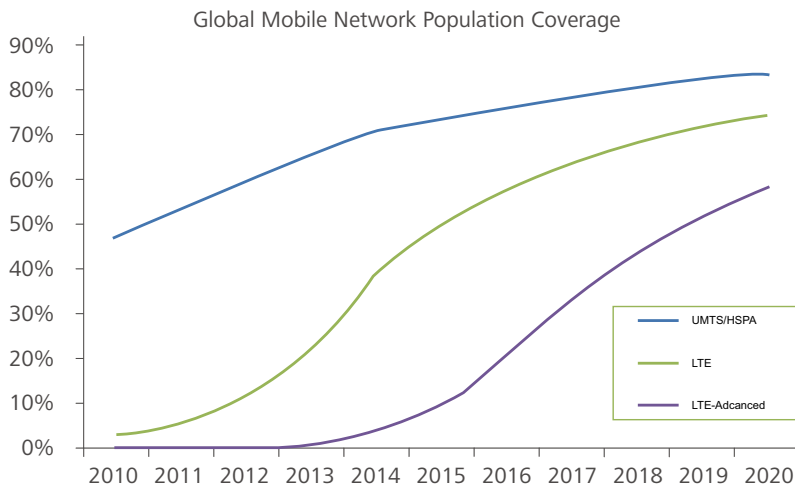


MOBILE VIDEO CONSUMERS ACROSS DIFFERENT MARKETS GENERALLY RATE VIDEO QUALITY HIGHER ON 4G NETWORKS THAN ON 3G BY 25%.

Mobile video adoption has benefitted from the increased availability of larger phone displays and higher quality networks, extending the opportunities where the smartphone is the best available screen for video viewing. With better device coupled with faster, lower-latency 4G networks, the improving video experience is removing the reasons for users to stop a video in frustration. And increased content accessibility and smarter recommendation engines are giving those users more reasons to carry on after their current video ends.

These quality of experience gains will continue to increase in the medium term. Strategy Analytics forecasts that LTE networks will cover 75% of the world's population by the end of 2020, up from under 50% at the end of 2015. There is significant momentum behind 4G networks today, with 25% of wireless connections at the end of 2016 forecast to be on 4G LTE, contributing to 49% of operator service revenue as 3G connections peak.

Exhibit 15: Mobile Network Evolution



LTE networks will cover **75%** of the world's population by the end of 2020

Source: Strategy Analytics' Wireless Operator Strategies, 2016

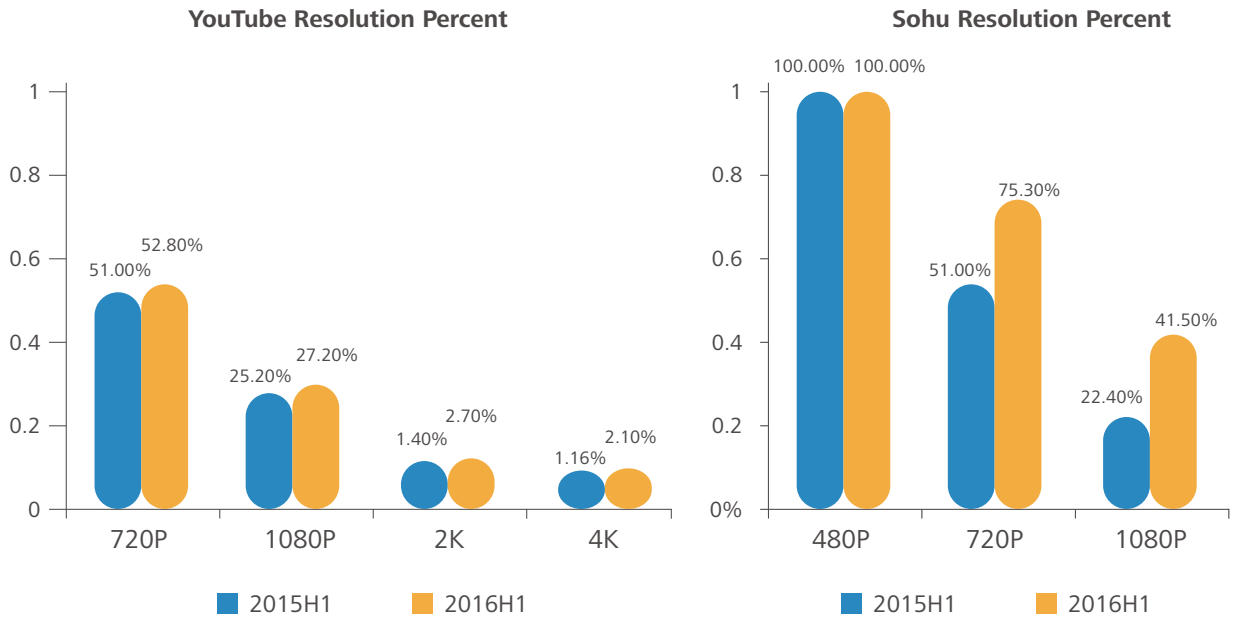
The global rollout of fast 4G networks has enabled video content of higher resolution (bitrates) to be delivered over mobile networks. Exhibit 16 shows that OTT services, e.g. YouTube and Sohu, were able to transport more higher resolution content in 2016 H1 than in 2015 H1, enabled by broader deployment of 4G networks. This in turn makes the viewing experience more pleasant. According to Huawei's video mean opinion score (U-vMOS) data, mobile video consumers across different markets generally rate

4G higher than 3G by 25%. It is particularly noteworthy that consumers' assessment of video streaming experience is especially impacted by how fast the streaming starts. U-vMOS is positively related to Video Initial Max Downlink Rate (see "Network Driver" section in Chapter 3 for more detail).

Exhibit 16: Share of content by resolution, 2016H1 vs. 2015H1

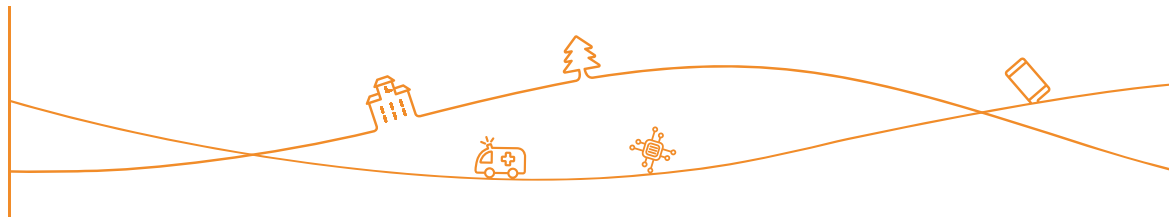


720P OR HIGHER DEFINITION CONTENT ARE AVAILABLE AT 52% IN YOUTUBE, 75% IN SOHU



Source: Huawei mLAB, 2016



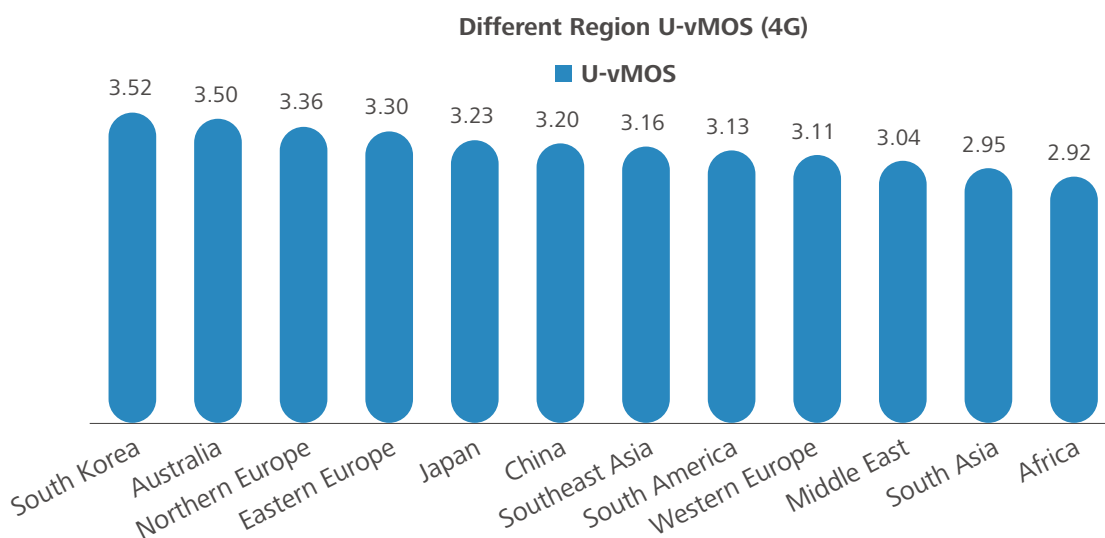


Mobile video consumers across different markets generally rate video quality higher on 4G networks than on 3G. Huawei's SpeedVideo test tool evaluated video experience based on data collected from 140 countries all over the world. The following figure shows the video mean opinion score (U-vMOS) of mobile videos obtained in each region by the end of the first quarter of 2016. 4G networks in

South Korea, Australia and Northern Europe rank the tops in U-vMOS. The same regions recorded U-vMOS scores in the 2.4-3.1 range for video over 3G networks.

4G THE 4G NETWORKS IN SOUTH KOREA PROVIDE THE BEST U-V MOS SCORE

Exhibit 17: 4G U-vMOS Scores by Region, Q1 2016



Source: Huawei mLAB, 2016

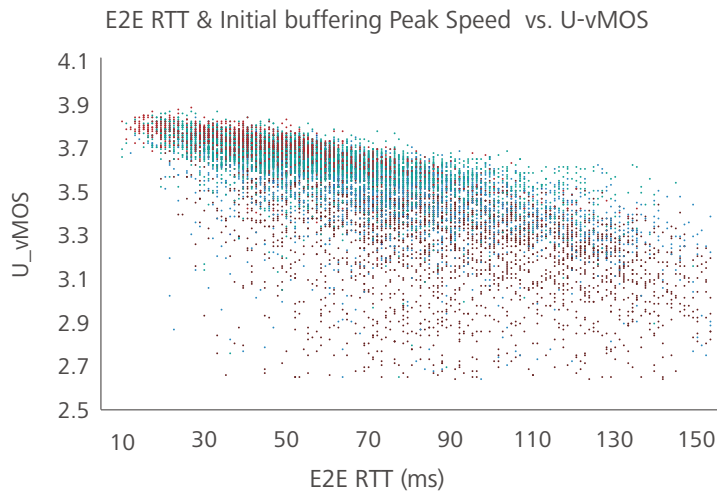
Huawei mLAB has studied the impact of network capability on U-vMOS for a long time through theoretical analysis, laboratory verification, and big data analysis of SpeedVideo on the live network. Based on the SpeedVideo data on the live network, we can see that U-vMOS is negatively correlated to E2E RTT, and positively correlated to the Video Initial Max Downlink Rate. In addition, the Stalling

Ratio, a key element in the user experience, is negatively correlated to the Video Total DL Rate. For a 1080P video with 2.3 Mbps bit rate, 80% of samples in all stalled test results have Video Total DL Rate lower than 3 Mbps (1.3 times the bit rate of the video), while the stalling ratio is nearly zero when the Video Total DL Rate is higher than 7 Mbps.



Exhibit 18: 4G U-vMOS Scores by Video Initial Max DL Rate

● 0~10Mbps ● 10~20Mbps ● 20~30Mbps ● 50~60Mbps



Source : Huawei mLAB, 2015H2



Better video experience requires faster MAX DOWNLOAD Rate and lower END TO END LATENCY.

The good news for end-users is that the mobile networks are evolving to overcome this quality of experience challenges. Alongside the greater availability of 4G/4.5G(LTE-Advance Pro) networks, helping to deliver lower latency and faster DL rates, network planning to identify and solve localized network capacity issues and the densification of networks with small cells, which reduce the distance between the user and the base station and EPC, are contributing to QoE gains for the user. The evolution of content delivery networks (CDNs) into future CloudRAN platforms will also further improve latency and QoE.

In addition, the greater availability and performance of Wi-Fi networks is also helping to boost the mobile video user experience. The majority of mobile video traffic

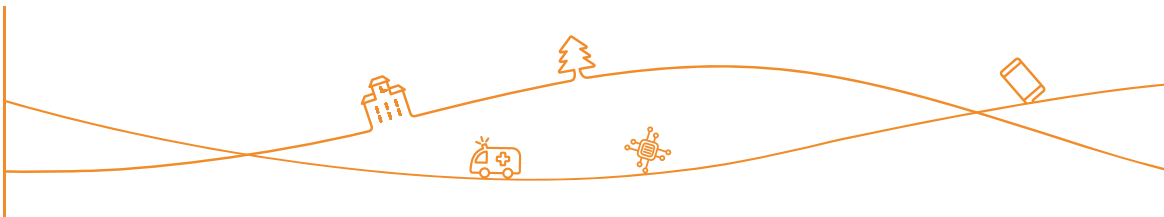
today is carried by Wi-Fi, rather than cellular networks, however this is stimulating, rather than threatening, the demand for 3G/4G video usage. Consumption of video on smartphones and tablets over Wi-Fi networks in consumers' homes, places of work or study, or in public venues helps to establish behavior patterns and increase end-user dependence on video services, which in turn builds video as part of the basic mobile service experience on cellular networks. For many mobile operators, Wi-Fi is an important part of the mobile network, providing complementary capacity for mobile services in areas where they is often low willingness to pay for cellular data, for example in users' own homes.

3.1.4 Larger, Faster, Richer Devices Boosting Video Service Experience

Better and more power mobile devices are a further piece in the jigsaw of a more pleasant view experience, together with faster network and improved content quality. Bigger displays with higher resolution translate the content quality to direct consumer experience gains. The phone is the dominant video device for a number of use cases, ranging for catch-up TV viewing outside of the home to its advantages for finding and sharing shorter clips. However, larger phone displays are also helping to increase the adoption of longer form video in traditional "large screen" environments.



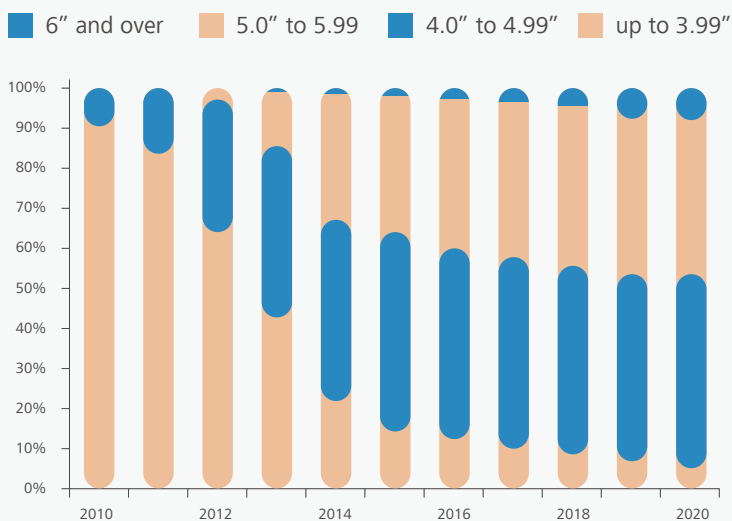
BIGGER DISPLAYS WITH HIGHER RESOLUTION TRANSLATE THE CONTENT QUALITY TO DIRECT CONSUMER EXPERIENCE GAINS



According to the analysis by Huawei mLAB, the most popular screen size of smartphones on which consumers watch mobile video has grown from 4-5 inch in 2013, which accounted for 49% of the terminals released, to 5-6 inch in 2015, which accounted for 66% of new models. The mix of device sales typically lags these model launches,

with larger screen, more expensive, devices also taking a smaller share of global sales volume, and Strategy Analytics estimates that smartphone displays of 5 or more inches will account for over 40% of sales by 2017.

Exhibit 19: Smartphone Screen Size Evolution



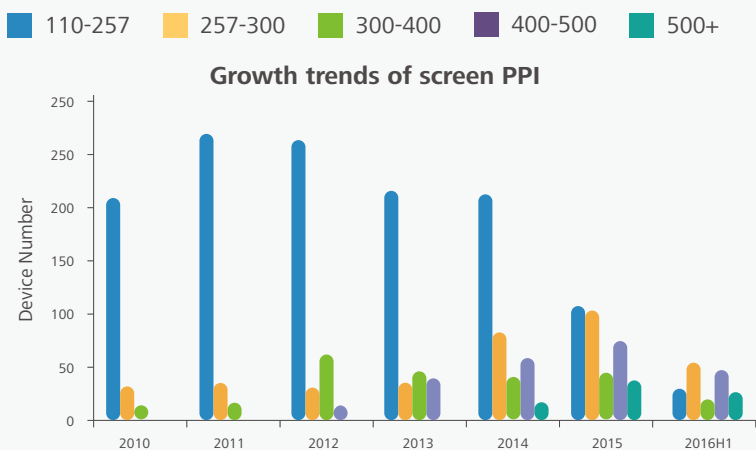
66% of new smartphones with **5-6 INCH** screen were released in 2015

Source: Strategy Analytics' Wireless Smartphone Strategies, 2016

Meanwhile, display resolution, as measured by PPI, is also going up. While the number of smartphones with display less than 257 PPI still accounted for 52% of the model launches in 2014, according to mLab's analysis, the

weight of smartphone of higher than 257 PPI accounted for over 70% of the total a year later. consequentially, 15% of new smartphone models are equipped with 2K display, and 40% with 1080p display in the first half of 2016.

Exhibit 20: Number of Smartphone Models Launched by Display PPI



70% of new released smartphones were equipped with display resolution **OVER 257 PPI** in 2015

Source: Huawei mLAB, 2016

3.1.5 Video Content Options Evolving Rapidly, with Live Video Stimulating Network Use



Content availability is expanding rapidly to accommodate all use cases and user preferences.

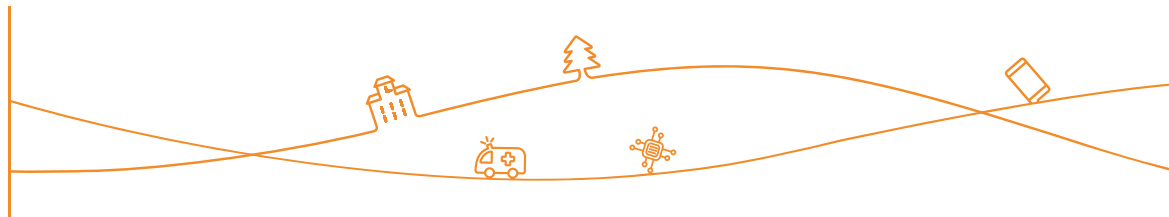
Alongside more affordable data plans and a better quality of experience, the increased breadth of video content and services has helped to drive adoption. The range of video content is continually expanding and mobile is a key part of the anytime, anywhere dynamic of video consumption patterns, extending the opportunities for users to binge watch box sets, avoid missing that must-watch TV episode or live event, or just casually filling up a short period of down-time.

Content drivers fuelling video usage on mobile devices include:

- The wide availability of “professional” video services in the form of video-on-demand services, such as Netflix and Amazon Prime, and catch-up TV services, such as BBC iPlayer, tapping into the evolving consumer behaviour patterns for consuming TV content outlined in section 2.1. Exhibit 21 compares the number of major OTT video services available by territory, including OTT services offered by pay TV service providers, highlighting the relative scarcity of significant choice in more developing regions;
- The increased exploitation of mobile broadcast rights for large and small events, particularly sporting events. Arguably, the 2014 FIFA World Cup in Brazil was one of the first global successes for live mobile video. Citrix found that games towards the end of the competition were generating sizable traffic spikes on mobile networks, for example the “Brazil vs Germany game with a 20 times increase in data traffic across a single sports network, ESPN”;

- The sheer volume of content shared by individuals and brands across platforms such as YouTube and Facebook, and the improving search and recommendation functions making it easier to keep viewers watching.
- The emergence of live video sharing and broadcasting on social media platforms as an evolution of user generated video and “brand” promotion. This will not significantly boost the share of uplink traffic on networks, due to the one-to-many nature of live video sharing, though does create behaviour patterns where users will attach higher importance to the quality of network upload performance, rather than the current focus on download speed and quality. Services such as Periscope, Facebook Live, and Snapchat are providing new ways for celebrities and brands to connect with their fans, changing us all from potential content creators to potential broadcasters.





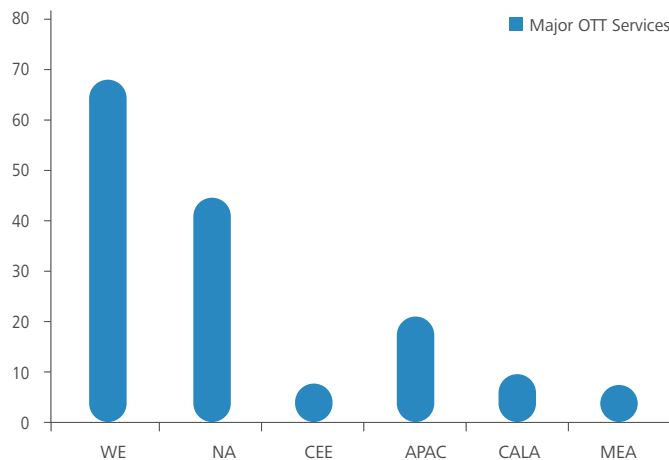
– According to Twitter, live streaming application Periscope generated 200 million broadcasts in its first 12 months (ended March 2016), and has been growing in momentum. Half of those broadcasts were generated between January and March 2016. Twitter claims 110 years’ worth of live video is watched per day across iOS and Android apps, up 91% from August 2015.

– Content providers are also leveraging the audience reach of social media to stream live video events. In April 2016 Twitter acquired the rights to stream Thursday night National Football League (NFL) games worldwide. The partnership includes in-game highlights and broadcasts from players and teams via Periscope. US broadcaster NBC Sports is going to leverage Periscope’s integration with GoPro to enable fans to live stream activity via the @NBCSN Twitter and Periscope accounts.

- Social media has evolved beyond initial text and images to include or facilitate video sharing, to keep consumers engaged within those apps for longer.
 - According to a report from Citrix (Sept 2014): 47% of social networking data can be attributed to video and 40% to images. Taking a regional view, North American and the Middle Eastern subscribers have the highest video consumption on social networks with video data volume constituting 59% and 62% of total volume, respectively. In comparison video consumption accounts for 39% of European mobile social networking data usage, with Asia-Pacific following closely behind at 35%.
 - In February 2016 WhatsApp reported 250 m videos sent daily across 800 million monthly active users, equating to an average of 9 videos per user monthly user. This is an over 55% increase from January 2015, with 100 m daily videos sent from a base of 500 million users.

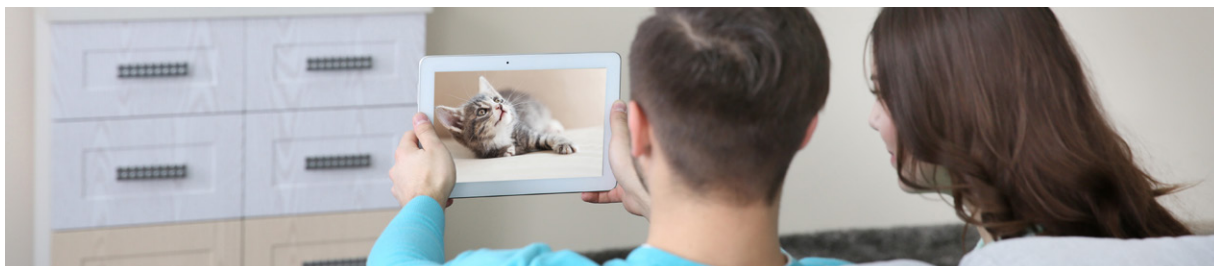
Exhibit 21: OTT Video Content Maturity by Region – Number of OTT Services by Market

Major OTT* Services by Territory: Aug 2015



Source: OTT Video Service Tracker, Strategy Analytics, Aug 2016

Vibrant content ecosystem matching broad range of consumer tastes





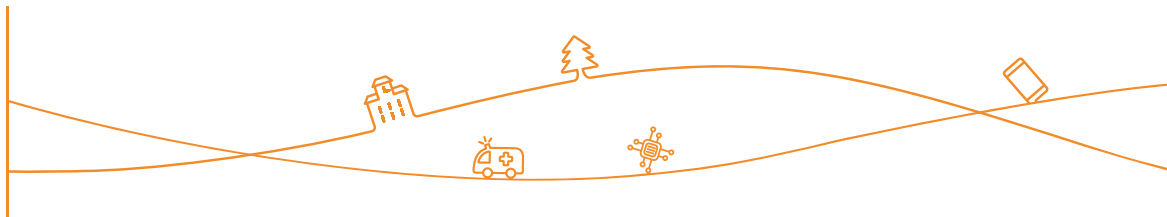
Content providers are also driving up bandwidth requirements with higher image quality and immersive video services.

As the availability of content increases, content providers are also responding to the technical drivers of better networks and more capable devices and will increasingly look to mobile as a platform more than capable of supporting higher bandwidth content. 4K & higher-definition video, in addition to YouTube 360, Facebook 360 video, and virtual reality, will all help to increase consumer enjoyment of and immersion in video content, and will also put significantly additional bandwidth pressures on mobile networks.

This move to higher-definition video is also being facilitated by the use of higher quality and higher efficiency codecs. The H.264 video compression standard is one of the most commonly used in video content, though is making way for H.265, which will further enhance the user experience for mobile video. H.265, also known as High Efficiency Video Coding

(HEVC) is the next-generation video coding standard released by ITU-T in 2003. Based on H.264, several technological progresses have been made in H.265 to improve the relationships between code stream, coding quality, delay, and algorithm complexity to achieve the optimal settings. H.265 aims to transmit network videos with higher quality using limited bandwidth. Using half the bandwidth required originally, H.265 can implement the playing of videos with the same quality. It supports the playing of both 4K (4096x2160) and 8K (8192x4320) ultra HD videos.

Support for the H.265 standard has seen growing on both mobile chipsets and also browsers. However, while its coding efficiency is higher than that of H.264, it is experiencing some challenges, principally the result of the patent environment. The new H.265 patent pool organization, HEVC Advance, established in April 2015 by Dolby, Philips, Mitsubishi, GM, and Technicolor, is charging higher fees to both device manufacturers and content providers, impacting adoption.



Telecoms service providers have embraced video as part of the wireline service bundle and are increasingly turning to mobile video content acquisition and bundling.

The dominance of video in entertainment consumption patterns has created a landscape in transition, as players across the video value chain extend their reach and adapt their focus. From content creation, through aggregation, distribution, and transport, content and service providers are collaborating and competing to win audiences and maximize customer value.

Multiplay service bundling has been a key feature of the telco landscape this decade, driving global operator consolidation efforts, as service providers seek to reduce churn, increase ARPU, and offer new services to customers. Creating double, triple, and quad-play service options has been a proven strategy for achieving these goals, and customers have been drawn to the cost savings on offer. This dynamic has made video services a central part of the service proposition for broadband providers around the world and consumers have responded positively to this trend in markets with strong multiplay competitive dynamics. For a growing number of consumers, video is a standard service feature they expect their broadband service provider to offer, a preference which mobile operators are now increasingly addressing.

This change in the ecosystem has seen a consistent wave of mergers and acquisitions between fixed, cable

and mobile operators, and has also resulted in telco acquisitions of video and content assets. The US has been a strong example here, with AT&T acquiring DirecTV, and Verizon acquiring AOL, creating a digital video content joint venture with Hearst Media and subsequently investing in Multi-Channel Network (MCN) AwesomenessTV. These deals highlight the importance of content, rather than simply the offer of generic video platforms, to telco positioning. As exclusive rights have been key to broadcaster differentiation in the pay TV market, exclusive digital media content is becoming a differentiator for telco video services as they compete against Netflix and YouTube.

There is also an increasing recognition by brands and content companies that mobile is a big growth driver for video and for reaching target consumers, which is shifting their willingness to negotiate digital rights for mobile dissemination of content. It is also driving up spend on mobile advertising and brand campaigns, and growing the market for "made for mobile" video content and ads. The improved ability to deliver and measure end-to-end QoE for video is reassuring companies that their content is seen with good quality to enhance their brand. In addition, the emergence of solutions enabling sponsored data are appearing in some markets, notably the US and China, increasing the opportunities for brands and others to cover the cost of data for video viewing, expanding their opportunities to engage with customers.



3.2 Mobile Video is Not a Supplementary Service: It is now a Basic Mobile Service Expectation

With video as the dominant data traffic category on mobile devices, mobile network operators must view its support as a basic competitive requirement for success. For many operators, it will not be enough to simply offer a network capable of supporting high quality mobile video services, they will need to make video a central part of their service offering and value proposition. We have shown in this section how many factors have come into play to make video a central requirement for the customer service experience and these factors are all fuelling each other to drive adoption forward. Demand-side drivers in behavior patterns, quality of experience and affordability, are propelling supply-side factors in video-optimized devices and networks, content provider and app developer eagerness to embrace mobile video, and a TMT service provider ecosystem that is re-aligning to become the platform of choice for mobile video in all its forms. And these supply-side complete the circle by further driving up demand by enhancing the quality of experience, affordability, and ubiquity of mobile video.

While these drivers propel video to the centre of the mobile service experience, the stage of service evolution around the globe is still quite diverse. Operators will need to co-ordinate their product and service development to tap into the video opportunity at the appropriate moment. In markets with low coverage of higher-speed networks, both 4G and Wi-Fi, now may not be the time to aggressively push data pricing to fuel a video boom. However, in all regions, operators should evaluate the influence they have on all of these service drivers to ensure they are ready to exploit the mobile video opportunity as it emerges.

As we plot these demand-side and supply-side drivers on to a mobile video maturity scorecard, we can see that developing markets have yet to satisfy sufficient criteria for significant mobile video adoption. We have ranked a number of regions based on relative maturity or penetration and adoption of the individual drivers as follows:

- **Socio-demographic and behavioral drivers**, shown here as **consumer** readiness and demand for video. Developing markets are typically not lacking on socio-demographic criteria, with younger populations which have been the drivers of video adoption in developed regions offering a potential customer base more



FOR MANY OPERATORS, IT WILL NOT BE ENOUGH TO SIMPLY OFFER A NETWORK CAPABLE OF SUPPORTING HIGH QUALITY MOBILE VIDEO SERVICES, THEY WILL NEED TO MAKE VIDEO A CENTRAL PART OF THEIR SERVICE OFFERING AND VALUE PROPOSITION

receptive to high levels of video consumption. Lower levels of TV and PC penetration have, however, resulted in lower video consumption overall across all platforms, dampening the demographic effect;

- **Economic drivers** in the form of **data pricing** levels and affordability, and data pricing options, including availability of large data bundles, video-centric pricing or sponsored and wholesale data platforms. As seen in section 3.1.2 there are clear gaps between the affordability of mobile data in developing versus developed markets, with the generally lower costs of mobile data in developing markets undermined by the significantly lower disposable income levels;
- **Technical drivers** across **4G** network availability, **Wi-Fi** in public and private locations, and penetration of smart **devices**. While the coverage of 4G networks and the penetration of smart devices have put hard ceilings on mobile video adoption levels, it is important not to underestimate the role of Wi-Fi in stimulating video use on cellular networks. The availability and use of Wi-Fi in residential, business and educational environments has been a significant positive for mobile video adoption on mobile networks, offering a more affordable “on-ramp” for video consumption over Wi-Fi that builds patterns of behavior that permeate into mobile use. While 4G networks have provided a boost to mobile video quality of experience and adoption, Wi-Fi has also been a friend to the mobile operator in establishing the smartphone as an important device for video consumption;
- **Content drivers** in the form of the richness and breadth of mobile video services and the focus of local brands in using mobile video as a customer engagement tool. As noted in section 3.1.4 there is a relative scarcity of significant OTT video service choices in more developing regions, creating weaker consumer demand which holds back operator improvements in networks and pricing.

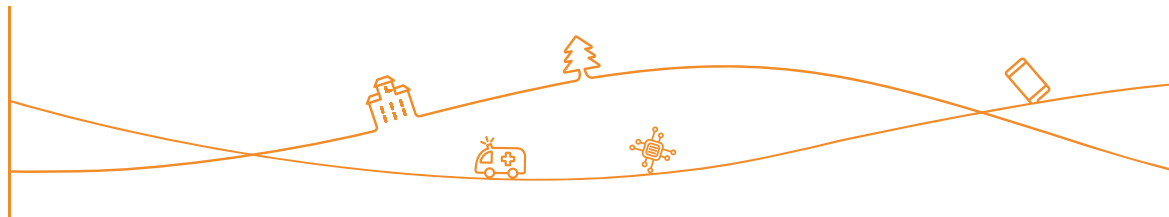
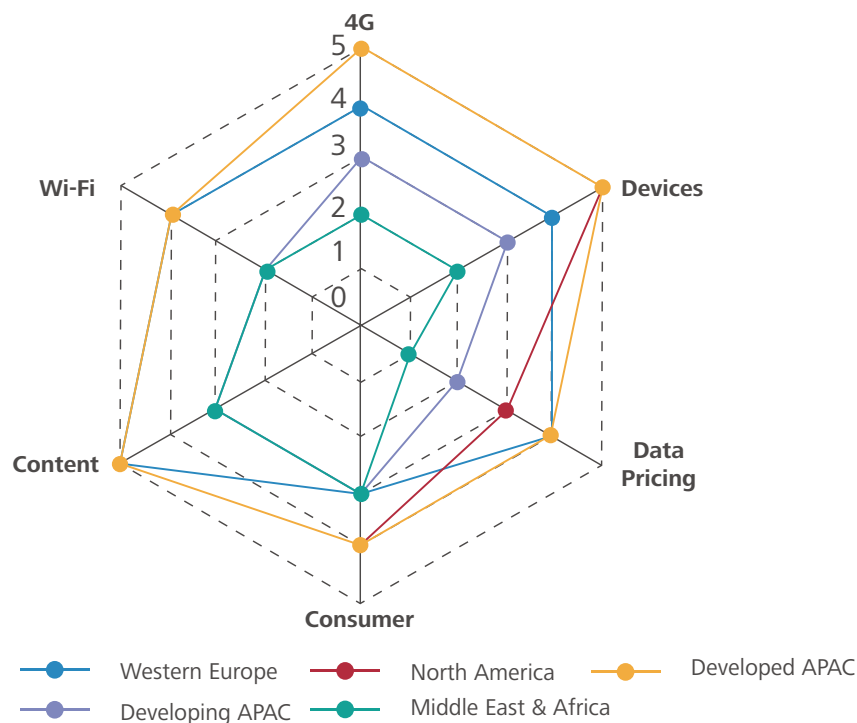


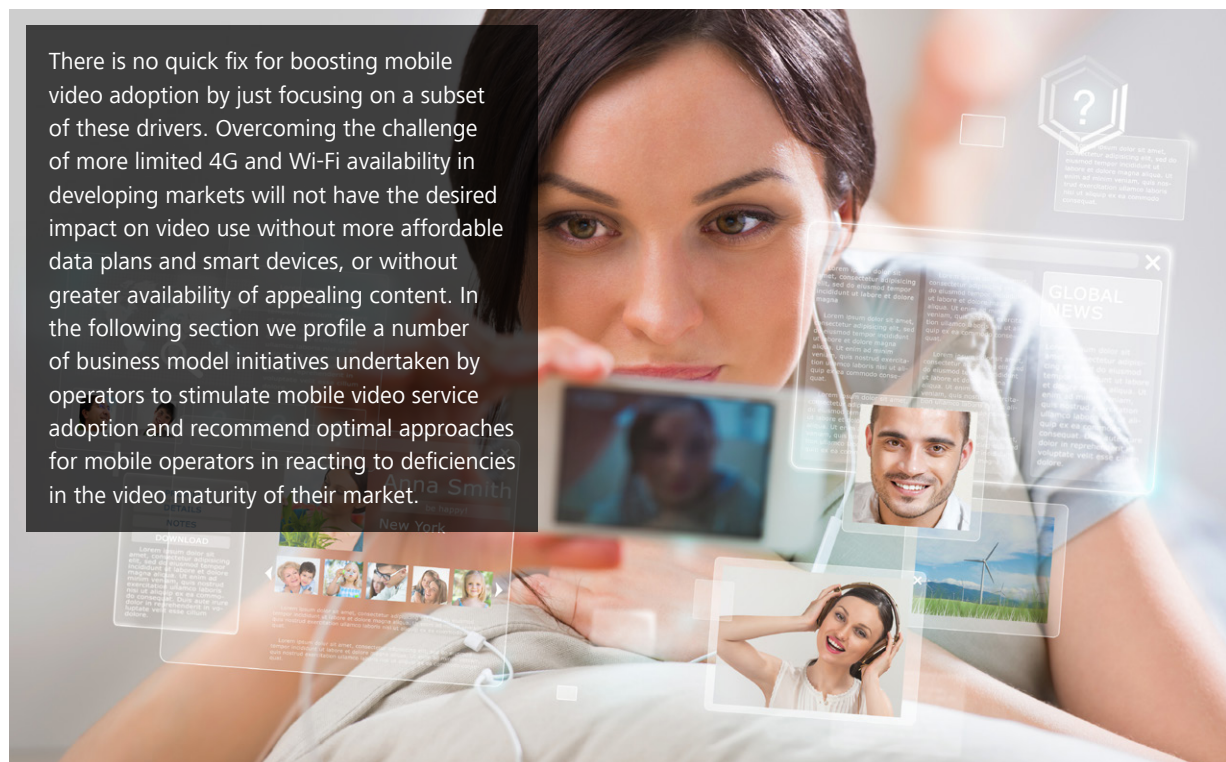
Exhibit 22: Mobile Video Maturity Scorecard by Region

Mobile Video Maturity Scorecard




Mobile operators will need to co-ordinate their product and service development to tap into the video opportunity at the appropriate moment according to mobile video maturity score.

There is no quick fix for boosting mobile video adoption by just focusing on a subset of these drivers. Overcoming the challenge of more limited 4G and Wi-Fi availability in developing markets will not have the desired impact on video use without more affordable data plans and smart devices, or without greater availability of appealing content. In the following section we profile a number of business model initiatives undertaken by operators to stimulate mobile video service adoption and recommend optimal approaches for mobile operators in reacting to deficiencies in the video maturity of their market.





4

OPERATOR STRATEGIES TO STIMULATE MOBILE VIDEO TRAFFIC



THE WORLD'S LEADING OPERATORS HAVE TAKEN MOBILE VIDEO AS A CORE BUSINESS STRATEGY AND MADE NOTABLE EFFORTS TO DEVELOP INNOVATIVE VIDEO SERVICE MODELS AND MONETIZE VIDEO TRAFFIC GROWTH

4.1 Case Studies on Successful Mobile Video Services

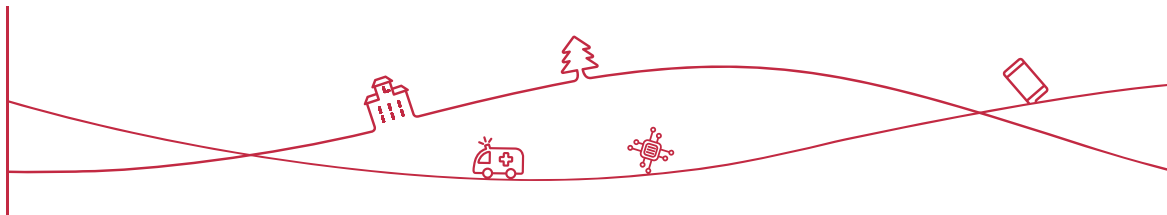
Rising consumer appetite for video consumption on mobile devices is driving many operators to develop a variety of strategies through which to capitalize and monetize video traffic growth. In this section Strategy Analytics highlights some of the notable efforts by carriers, summarized in the table below.

Exhibit 23: Mobile Video Service Business Models

	Own App/ Self platform?	Content Sourcing	Income Source	Video Allowance
Verizon Go90	Yes	Licensing	Advertising revenue, Sponsored data	No
Singtel HOOQ	Yes	Licensing	Monthly subscription fee	No
Vodafone Sky/ Netflix	No	Partnership with OTT	Upsell higher value tariff	No
T-Mobile Binge On	No	N/A	Upsell higher value plans	Integrated
LG Uplus	Yes	Licensing	Sell video tariffs	Integrated
Grameenphone	No	Partnership with OTT	Upsell video allowance	Add-on
Airtel	No	Partnership with OTT	Upsell video allowance	Add-on

Verizon has developed its own over-the-top (OTT) application for distribution via Apple App Store and Google Play. Verizon is licensing content for Go90 directly from content owners. Go90's business model is based on selling video advertising inventory (via its subsidiary AOL), but also allows advertiser to sponsor the data traffic for Verizon's postpaid users, thus promoting greater use. Similarly, Singtel has created its own OTT subscription video app, called HOOQ, offering

regional and international TV shows and movies. SingTel is licensing video content from content owners, including its joint venture partners, and will generate revenue by charging a subscription fee to customers for access its content. Clearly, developing an own video application requires mobile operators to move beyond their traditional businesses, representing a higher risk to tariff based approaches.



To avoid the risk associated with developing their own application, Vodafone and other operators (e.g. Orange) have elected to partner with brands like Sky and Netflix to bundle limited time access to their services into selected 4G tariffs, as highlighted in Exhibit 24. These services are typically bundled into higher value tariffs, provide another level of differentiation to vanilla voice, text and data tariffs offered by competitors, and can result in raised or maintaining ARPU. Vodafone has reported that content bundling has had a positive impact on driving

additional data usage as its customers migrated from 3G to 4G data tariffs. Subscribers adding Sky Sports Mobile TV and Spotify customers raised their data usage by 20% and 30% respectively compared to those users yet to add either content service to their 4G tariff. Furthermore, users opting for premium bundled video content services, like Netflix, are typically using more data across most major applications than those without video bundles, indicating that content bundling into tariff appeals to or drives heavier users of mobile data.

Exhibit 24: Vodafone's Video Service Bundling Options



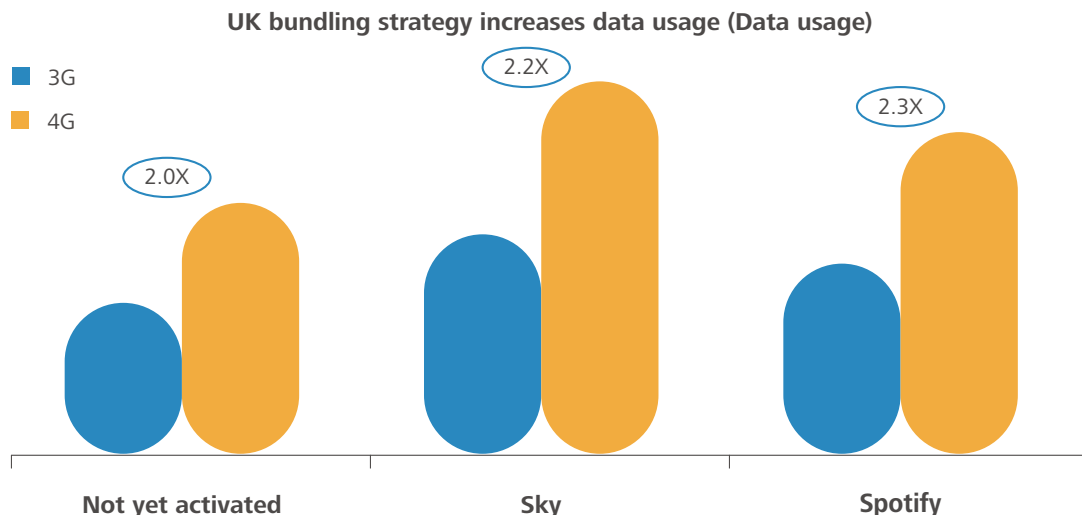
4GB Red Bundle SAVE 15%		8GB Red Value Bundle SAVE 15%		12GB Red Value Bundle	
Monthly cost	£18.70 £22	Monthly cost	£22.95 £27	Monthly cost	£32
4G UK data	4GB	4G UK data	8GB	4G UK data	12GB
UK minutes	Unlimited	UK minutes	Unlimited	UK minutes	Unlimited
UK texts	Unlimited	UK texts	Unlimited	UK texts	Unlimited
Inclusive roaming data*	2GB	Inclusive roaming data*	2GB	Inclusive roaming data*	4GB
Inclusive roaming minutes and texts**	Unlimited	Inclusive roaming minutes and texts**	Unlimited	Inclusive roaming minutes and texts**	Unlimited
<p>Choose bundle</p> <p>More information</p>		<p>Plus choose 12 months of:</p>  <p>Choose bundle</p> <p>More information</p>		<p>Plus choose 12 months of:</p>  <p>Choose bundle</p> <p>More information</p>	



Exhibit 25: The Impact of Video Service Bundling on Customer Data Usage



In March 2015 Vodafone reported 4.1 million content bundles across the 12 markets in which it bundles content, and video has reached 48% of total network traffic.

As an alternative to providing an own or third-party video app, T-Mobile USA’s Binge On provides customers with access to zero-rated access to partner video streaming services, as long as users opt into receiving video delivered at standard definition rates. To qualify for Binge On T-Mobile customers need to migrate to a higher spend plan, therefore creating ARPU uplift for T-Mobile and simultaneously reducing network congestion.

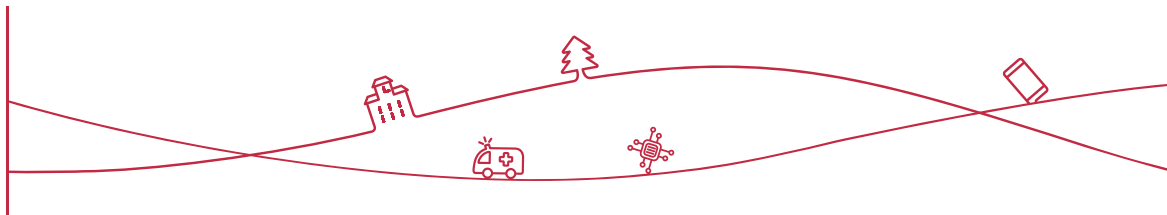


T-Mobile USA claims Binge On has had a positive impact on its business since its launch:

- **Customer and ARPU growth:** T-Mobile claims partners like Netflix are seeing large increases in daily viewers, while T-Mobile has seen robust growth in both net-additions and ARPU, with the latter due to the tariff price rises introduced to its Simply Choice plans in tandem with Binge On. For example, in order to qualify for Binge On customers had to sign up to 3GB tariffs, with many needing to do so with from lower priced 2GB data plans.
- **Overall drop in data traffic:** T-Mobile claims Binge On has been a success, stating in its Q4 2015 financial reporting that data traffic on its network has declined by between 10%-12% since launch.

PRICING REMAINS A CRITICAL LEVER FOR MOBILE OPERATORS TO ENABLE THE CONTINUED GROWTH IN VIDEO USAGE WHILE SIMULTANEOUSLY MONETIZING THAT CONSUMPTION.

- **Video traffic usage:** 70% of video traffic on T-Mobile’s network is covered by Binge On, and users have doubled their video consumption. 34 Petabytes of video data streamed by end January 2016, the equivalent of over 5.3 million standard DVDs of video content.



- More video content providers:** Binge On has grown the number of video content provider partners since launch from 24, including Netflix, Hulu and HBO, to over 40 by the end of March 2016, including YouTube. A growing list of partners indicates Binge On has proven to be a compelling platform for leading video content providers.

LG Uplus has defined video centric postpaid plans which provide users with an additional 1 GB of daily video on top

of standard data allowances. The video tariffs are offered at a premium to voice and data centric plans (Exhibit 26), and will therefore serve to raise ARPU and drive video consumption. In Bangladesh Grameenphone and Airtel are selling video allowances for access to popular video services (YouTube, Popcornlive) as an add-on tariffs (Exhibit 27). Customers with an increasing appetite for video will be attracted to these tariffs and consequently raise their video consumption.

Exhibit 26: LG Uplus Video Centric Data Plans

VOICE Data Plan				VIDEO Data Plan					
Plans	Voice & Text	Data	VAS		Plans	Voice & Text	Data	VAS	
29.9	Unlimited	300MB	VIDEO Portal	300MB	38	Unlimited	300MB	VIDEO Portal	1GB Video Data / Day
35.9		1.3GB		600MB	44		1.3GB		
41.9		2.3GB		1.1GB	50		2.3GB		
46.9		3.6GB		2.2GB	55		3.6GB		
50.9		6.6GB		3.3GB	59		6.6GB		
59.9		11GB		Unlimited	68		11GB		
<small>Launched 2Q 2015</small> <small>*Unlimited Data: Speed reduced to 3Mbps after exceeding 2GB/day</small>				<small>Launched 1Q 2015</small> <small>*Unlimited Data: Speed reduced to 3Mbps after exceeding 2GB/day</small>					
					80		20GB		LGHH Gift Points 5,000/mth.
					100		35GB		Asiana Mileage 20,000/yr

Exhibit 27: Grameenphone and Airtel Bangladesh Video Packs

Operator	Package	Volume	Validity	Price
Airtel	Video Pack 1	75 MB	2 days	10 Taka (US\$ 0.13)
Airtel	Video Pack 2	400 MB	7 days	50 Taka (US\$ 0.64)
Airtel	Video Pack 3	1 GB	30 days	130 Taka (US\$ 1.66)
Grameenphone	Video Package 10	10 MB	1 day	2 Taka (US\$ 0.03)
Grameenphone	Video Package 40	40 MB	1 day	5 Taka (US\$ 0.06)
Grameenphone	Video Package 150	150 MB	7 day	15 Taka (US\$ 0.19)

4.2 Key Recommendations for Operators to Exploit End-User Mobile Video Expectations

As discussed in section 3 there are a broad range of drivers supporting continued strong growth in mobile video adoption and consumption, with different regions at various stages of evolution within the framework of the video maturity scorecard. Given its significance to overall usage patterns, stimulating video traffic will be central to many mobile operators' revenue growth prospects. Recommendations for boosting scores and maximizing opportunities within the video maturity scorecard can be viewed on a number of axes.



4.2.1 Bundling & pricing

Pricing remains a critical lever for mobile operators to enable the continued growth in video usage while simultaneously monetizing that consumption. High per MB overage fees and the fear of burning through data caps has held back widespread video usage on mobile. However, initial results from services such as Binge On and LG's LTE Video based plans validate a willingness to pay a premium for zero-rated or unlimited mobile video use. Pricing strategies should focus on:

- **Video centric tariffs**, enabling operators to directly monetize rising video consumption on mobile while allowing consumers to decide the relative importance of video within their mobile tariff. Making video an explicit part of the basic mobile tariff can help to encourage more video use, so stimulating revenue.
- **Pricing "on-ramps"** in the form of plans and promotions to encourage new users to try mobile video, such as video snacking packs, and offers of zero-rated or additional data for time-based or episode based video. For converged operators with multiscreen offers, promotions to get home TV users active on mobile will help to stimulate video use outside of the home.

These video-based options can address both active and casual users of mobile video, maximizing growth potential in the market and will help to overcome affordability issues across market segments. Operators can boost data pricing scores on the video maturity scorecard on both of these dimensions: higher-value video-centric plans to tap into existing consumer demand for video services, and also smaller snacking options for more price sensitive customers in both



VIDEO-BASED PLAN CAN ADDRESS BOTH ACTIVE AND CASUAL USERS OF MOBILE VIDEO, MAXIMIZING GROWTH POTENTIAL IN THE MARKET AND WILL HELP TO OVERCOME AFFORDABILITY ISSUES ACROSS MARKET SEGMENTS

developing and developed markets.

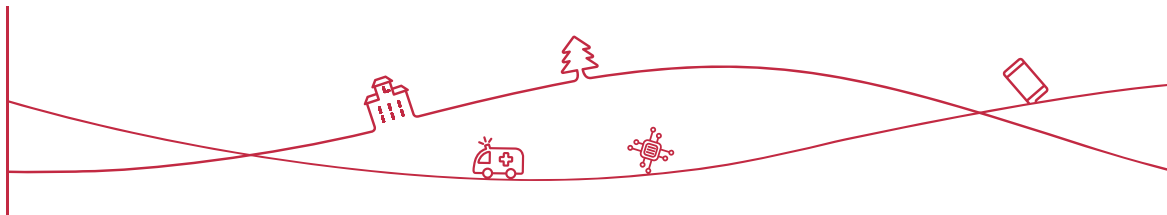
However, operators must carefully consider legislation on, or consumer sentiment towards, net neutrality when developing pricing strategies for mobile video services. Many consumers perceive value in zero-rated content, though operators should focus on delivering these on open platforms which do not discriminate against video service provider.



OPERATORS CAN MONETIZE HIGH QUALITY VIDEO EITHER BY ASSUMING CONSUMERS WILL USE MORE OF THEIR DATA ALLOWANCE RAPIDLY, AND BUY ADDITIONAL DATA BUCKETS WHEN NEEDED, OR BY CHARGING A PREMIUM FOR ACCESS TO HD CONTENT

4.2.2 Quality 'v' Optimization

The early success of T-Mobile USA's Binge On has shown that consumers are prepared to trade-off video quality in exchange for a more optimized streaming experience. For example, while HD video provides a clear viewing experience, a buffer and jitter free video viewing experience is also of high priority. Conversely, operators can monetize high quality video either by assuming consumers will use more of their data allowance rapidly,



and buy additional data buckets when needed, or by charging a premium for access to HD content, as LG in Korea has done. Quality of Experience improvement strategies should focus on:

- **Network upgrades:** Operators do need to invest in network capacity and quality to meet consumer expectations and avoid poor experiences which can impact future willingness to engage with mobile platforms. U-vMOS is a useful metric in evaluating network upgrade and optimization options, to prioritize resources in order to maximize QoE improvements.
- **Addressing in-home performance:** With most video consumption occurring in the home it remains important for mobile operators to provide a sufficiently robust solution to meet indoor video streaming. Wi-Fi should be considered part of the mobile operators' technology toolbox here, though in markets where home Wi-Fi penetration remains limited video optimization should be used to extract most value from available network resources.

Evolutions of 4G LTE will be important in delivering the mobile video quality expected by users. Operators in developing markets can boost their video maturity score by expanding their 4G footprint, while scores in more developed markets with high levels of LTE population coverage can be lifted through a focus on enhancing



urban network capacity using features such as Carrier Aggregation and MIMO, and by evolving ICT network architectures to reduce E2E RTT in order to bring video providers and content delivery networks closer to the end-user.

4.2.3 Own-branded Video 'v' Exclusive Collaborations

**THERE ARE SIGNIFICANT FINANCIAL TRADE-OFFS BETWEEN SOURCING CONTENT FOR OWN-BRANDED VIDEO SERVICES VERSUS PARTNERING WITH EXISTING VIDEO SERVICE PROVIDERS.**

Operators must respond to local market dynamics when evaluating the role of their brand in the video services market. There are important ways in which operators can exploit the video content ecosystem to boost their video maturity score:

- In regions with strong OTT and social video service adoption, the best opportunity may be for **promotional collaboration** with these brands, using free and

exclusive offers for Netflix, Amazon Prime, and others as a customer acquisition and retention tool for high usage segments.

- In highly mobile-centric market environments (particularly in developing countries), there will be gaps in the market where operators can **develop their own video services**, due to the weaker market traction of video service providers. Operators can provide operator billing with their services in order to address the market of prepaid and postpaid customers that do not have access to their own credit or debit card.
- Even in highly developed video markets like the US, there are niches that operators can play in, with Verizon's go90 service a good example. Here, operators need to carefully source **focused content** in order to build momentum with targeted segments, rather than trying to compete directly with YouTube or Netflix.

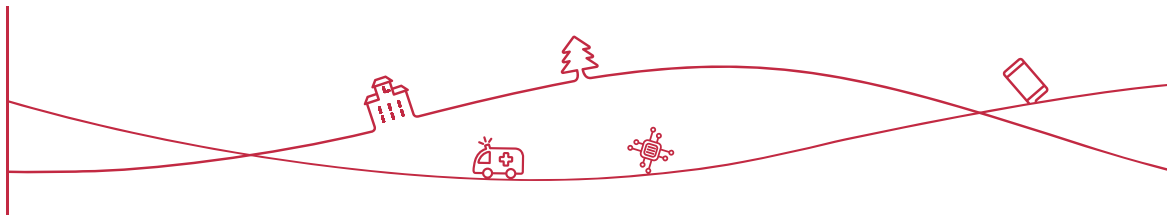
There are significant financial trade-offs between sourcing content for own-branded video services versus partnering with existing video service providers. Netflix's scale still only delivered a 4.5% operating margin in 2015 and mobile operators should view their own video service as stimulating revenue and profitability in their core data business, rather than one which is likely to deliver short term returns in their own right.

Partnerships with existing video brands will offer more rapid returns, though these brands typically do not want long term exclusive commitments: they can be useful to build an operator reputation for offering a high quality service experience and have been used successfully to kick start 4G service adoption in a number of countries.

4.2.4 Regional Priorities for Video Maturity Scorecard Improvement

In terms of specific priorities for regional markets to increase their video maturity scores and exploiting the related revenue growth opportunity, we view the following regional strengths and immediate priorities for video service stimulation.

Region	Current Strengths	Future Priorities
Western Europe	<ul style="list-style-type: none"> Mature region in terms of technology availability and device ownership. 	<ul style="list-style-type: none"> Deploying faster networks more broadly to serve growing demand for mobile video from younger generations (for news, information and entertainment especially in always-on social networks) Ageing demographic a challenge for advanced video service adoption; with bite-size pricing options without bill shock, and zero-rating key. Demand for local video content not yet fully executed across diverse markets.
North America	<ul style="list-style-type: none"> Mature region in terms of technology availability and device ownership. Vibrant content ecosystem matching broad range of consumer tastes. 	<ul style="list-style-type: none"> Offering competitive data tariff and package to remove user concern for surprise overage charges
Developed APAC	<ul style="list-style-type: none"> Mature region in terms of technology availability and device ownership. Significant operator influence in web/content value chain. 	<ul style="list-style-type: none"> Drive 4.5G network performance and capacity to boost QoE for advanced/immersive video service.
Developing APAC	<ul style="list-style-type: none"> Pockets of rapid 4G adoption (e.g. China) and healthy data pricing innovation, though often not as focused on volume use cases. 	<ul style="list-style-type: none"> Affordability a key barrier to video adoption. Operators need to focus both on low-cost smartphones and also on reducing GB price of data for both high-volume use and data snacking. 4G network expansion and capacity upgrades important to meet potential video demand.
Middle East & Africa	<ul style="list-style-type: none"> Youthful demographic with good video adoption potential. Emerging mobile focused video services 	<ul style="list-style-type: none"> Overall ecosystem improvement needed Operators should start offering more affordable tariff and more flexible packages (daily or weekly packages, snacking offer for prepaid users) The lack of dominant OTT services opens door for operators to take a more active role in sourcing and providing content





Exhibits

○ Exhibit 1: Mobile Video Maturity Scorecard by Region	02
Exhibit 2: Global & Regional Mobile Video Penetration 2010-2021	05
Exhibit 3: Mobile Data Consumption by Application Types, 2010-2021	06
Exhibit 4: Video as % of total mobile data by region	08
Exhibit 5: Minutes Spent on Leading Apps per User per Day, Q1 2016, USA	09
Exhibit 6: YouTube vs. Facebook Smartphone Usage Profiles	10
Exhibit 7: Video Content Growth on Mobile Networks	11
Exhibit 8: Video-on-Demand Smartphone Use by Age & Gender, UK	13
Exhibit 9: Application Scenarios for Immersive Video	14
Exhibit 10: Top Immersive Video Content Types	15
Exhibit 11: Mobile Data Costs: Revenue per GB Evolution	16
Exhibit 12: Mobile Data Costs: Data Plan Pricing Evolution	17
Exhibit 13: Distribution of Handset Tariffs by Data Allocation	18
Exhibit 14: Cost of Mobile Video as a Proportion of Disposable Income	18
Exhibit 15: Mobile Network Evolution	19
Exhibit 16: Share of content by resolution, 2016H1 vs. 2015H1	20
Exhibit 17: 4G U-vMOS Scores by Region, Q1 2016	21
Exhibit 18: 4G U-vMOS Scores by Video Initial Max DL Rate	22
Exhibit 19: Smartphone Screen Size Evolution	23
Exhibit 20: Number of Smartphone Models Launched by Display PPI	23
Exhibit 21: OTT Video Content Maturity by Region – Number of OTT Services by Market	25
Exhibit 22: Mobile Video Maturity Scorecard by Region	29
Exhibit 23: Mobile Video Service Business Models	30
Exhibit 24: Vodafone's Video Service Bundling Options	31
Exhibit 25: The Impact of Video Service Bundling on Customer Data Usage	32
Exhibit 26: LG Uplus Video Centric Data Plans	33
Exhibit 27: Grameenphone and Airtel Bangladesh Video Packs	33

Research Methodology:

Huawei and its related partners conduct regular observations on market maturity and drivers for mobile video contents. These observations aim to support the strategy making and external market communication of the mobile video industry. All data in this report comes from historical records and future projections, and is verified against internal data from Huawei. User data is collected anonymously before transferred to Huawei engineers. Main sources of data include Strategy Analytics (on macroeconomics, traffic trend, and business model), Huawei mLAB (on consumer behavior survey, service and terminal behavior, user experience research, and actual network capability), as well as other public third-party materials. Huawei MBB engineers are qualified with long-term research experiences. They strive to present the current situation of the drivers for mobile videos both comprehensively and impartially. They try to identify the development trend, and point out latent problems facing the industry. Note that data involved in this analytical report is bound to factors including time period, sample quantity, and level of research. All information provided is for reference only.

Trademark Notice

 , **HUAWEI** , and  are trademarks or registered trademarks of Huawei Technologies Co., Ltd. Other trademarks, product, service and company names mentioned are the property of their respective owners.

NO WARRANTY

THE CONTENTS OF THIS MANUAL ARE PROVIDED "AS IS". EXCEPT AS REQUIRED BY APPLICABLE LAWS, NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE MADE IN RELATION TO THE ACCURACY, RELIABILITY OR CONTENTS OF THIS MANUAL.

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO CASE SHALL HUAWEI TECHNOLOGIES CO., LTD BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, OR LOST PROFITS, BUSINESS, REVENUE, DATA, GOODWILL OR ANTICIPATED SAVINGS ARISING OUT OF OR IN CONNECTION WITH THE USE OF THIS MANUAL.

HUAWEI TECHNOLOGIES CO., LTD.

Bantian, Longgang District
Shenzhen 518129, P. R. China
Tel: +86-755-28780808

www.huawei.com