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# GDPR

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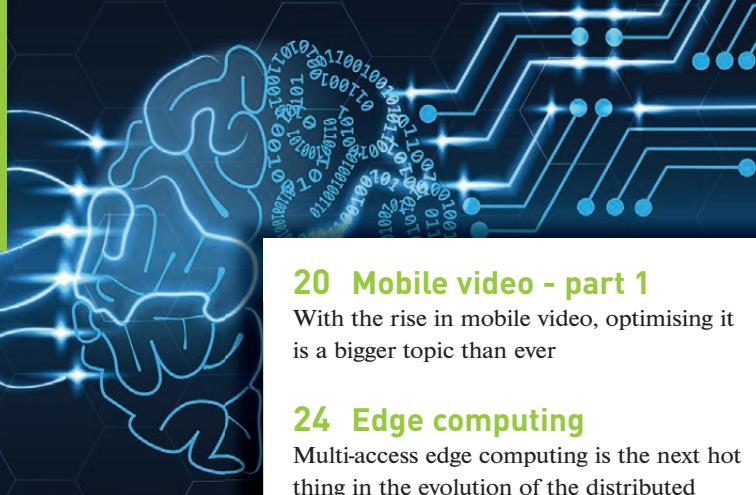
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The new 'golden age of TV' has arrived, spurred on by streamers like Netflix, Amazon, HBO and YouTube. The main TV set remains a central part of the viewing experience, but more and more consumption is taking place online and on other devices. Increasingly, traffic is in high definition and encrypted. From a technical perspective, this of course has big implications for the delivery and overall quality of experience (QoE) of the video. As with WhatsApp and data OTT services before them, operators are losing control of their networks. They are unable to manage subscriber QoE with conventional mobile optimisation, as we report in our two features looking at the topic of mobile video (pages 20 and 34). We also look at key trends shaping our industry today and tomorrow (p14) as it is customary at this time of the year. *Goran Nastic, editor*



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# CSI Awards 2018

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# Lawyer warns of impending payTV piracy tipping point

**A leading prosecution lawyer thinks the payTV industry has only two to three years to get to grips with the piracy problem, at least as far as legislation is concerned, unless considerable more is done to fight back..**

The onset of modern IPTV piracy dates back to around 2012 when Kodi boxes and online platforms became available that made the access to pirated content easy in terms of technology and inviting in terms of the user interface. It is now well documented the level of piracy has escalated to cost the payTV industry billions of dollars in lost revenues.

Ari Alibhai, a criminal practitioner with the QEB Hollis Whiteman firm, warned that the industry has only a small window of opportunity left to get to grip with modern streaming and payTV piracy.

“We only have a window of, I would say, two to three years to take the initiative by all means possible – education, PR, marketing – but also by ensuring that those at the top of the food chain of this fraud are prosecuted, in what is a serious and complex organised crime globally. Some can be sued, injunctions can be sought, but the criminal element is severely underused,” Alibhai said, speaking at the MESA Summit in London late last year.

Alibhai noted that only a handful of cases have ended in court despite the massive scale of the problem. In 12 years of his work, Alibhai said he has never seen a fraud grow as fast, and yet since piracy’s latest inception four years ago there have been only nine cases taken to criminal court. He thinks



that is not enough to dissuade the public or criminal elements.

The legal system is underused by all rights holders with the exception of the Premier League, which has taken some high profile cases on.

“The music industry has suffered enormously from digitisation. We’re not there yet in terms of sports broadcast, TV and films, but we all ought to take heed from what can happen when piracy starts to outstrip legitimate alternatives.

“We might lose that territory and it’s much harder to regain.”

## Liberty Global to offload some Euro assets to Vodafone and up content

**Vodafone has confirmed it is in early stage discussions with Liberty Global regarding the potential acquisition of certain overlapping continental European assets owned by Liberty Global.**

Vodafone said: “There is no certainty that any transaction will be agreed, nor as to the terms, timing or form of any transaction. Vodafone is not in discussion with Liberty Global regarding a combination of

both companies.”

Vodafone provides mobile networks in 26 countries, including joint ventures and associates, and fixed services in 17 of these, while Liberty Global operates in 12 European countries. The largest market in which the two operate is Germany, owning UnityMedia and the old Kabel Deutschland respectively. The two groups also have overlapping footprints in Romania,

Hungary and the Czech Republic. They merged their Netherlands subsidiaries in 2016 under VodafoneZiggo, but it is understood that any new deal will not follow that combination. It would, however, mark further downsizing at Liberty Global, which sold its Austrian and Swiss assets at the end of last year to Deutsche Telekom’s T-Mobile.

## news in brief

### New CEO at SES

The current CEO of SES Networks will become the next President & CEO of the entire SES group in April. Steve Collar, who is currently CEO of SES Networks, will take on the new role of president & CEO of SES, starting 5 April 2018. In the meantime, he becomes CEO Designate with immediate effect. Collar will replace Karim Michel Sabbagh, who is stepping down after the next Annual General Meeting (AGM) in order to spend time with his family and to pursue new interests, the satellite company said. A successor to Collar as CEO of SES Networks will be appointed in due course. Also, Andrew Browne, who was until recently CFO of O3b Networks and CFO of SES between 2010 and 2013, has been appointed as the next CFO of SES.

### CSI Awards now open

The CSI Awards 2018 are now open for entries. The awards have been around since 2003 to celebrate technical innovation in broadcast TV, OTT video, cable and associated sectors, for vendors, operators and more. New categories this year include the Best use of AI in video, Best TV user experience and Best IP playout, which join the other established categories. For more information, please see [csimagazine.com/awards](http://csimagazine.com/awards)

## news in brief

**Viacom and Telefonica reach big streaming deal in LatAm**

Viacom has reached a wide-ranging streaming deal for its channels across Latin America with Telefonica. Under the deal, Viacom's MTV, Nickelodeon, Nick Jr., Comedy Central and Paramount Channel will be available for live streaming and on-demand viewing by mobile and broadband subscribers of the Movistar Play platform in Latin America. The media company said this deal is a global first for Viacom. It's the first time Viacom has struck such a deal with a mobile carrier to carry all of its flagship networks as well as streaming and VoD content. It is also the first of its kind to be closed by Telefonica for its mobile and broadband subs.

**Charlie Vogt joins ATX**

ATX Networks has appointed Charlie Vogt as President and Chief Executive Officer. Vogt joins ATX following four years as President and CEO of Imagine Communications, where he transformed the company from Harris Broadcast to one that focuses on IP, software and cloud technologies. Vogt left Imagine suddenly in December, leading to speculation about his departure. He succeeds Ken Wildgoose, who steps down after 18 years at ATX, a supplier to the cable and satellite sectors.

**DVB moves towards targeted ads spec**

**The DVB has decided to go ahead with defining a set of commercial requirements for a future Targeted Advertising specification that seeks to overcome market and technology fragmentation.**

The organisation's Steering Board has approved the creation of a dedicated Commercial Module group that has set its sights on agreeing Commercial Requirements (CR) for TA by June this year. It is then expected that the draft specification would go before the DVB Steering Board for approval, and once

approved could pave the way for the first market implementations in 2020.

The specifications will be written in close cooperation with HbbTV, with a view to re-use all relevant existing or future HbbTV assets. The CM-TA Group will be co-chaired by Vincent Grivet of TDF and Angelo Pettazzi of Mediaset.

The move comes after DVB decided to set up a dedicated Commercial Module - Study Mission Group (SMG) in March 2017. Its purpose was to assess the relevance of generating a new DVB specification dedicated to

enabling targeted advertising serving at the very least classical broadcast television. The SMG published its final report in September 2017, which concluded that targeted advertising is of high commercial importance to broadcast TV, but suffers from the lack of a suitable enabling technical framework.

"There is a genuine appetite for TA to be made available for classical broadcast television. This is accompanied by the overall feeling that with too many technical solutions there is a risk of fragmentation in the marketplace that would hinder any progress. This is where the work of DVB on TA can help unlock the full potential of TA in broadcast television," said the CM-TA co-chairs in a joint statement.

**BBC develops AR app for new series**

**The BBC is launching its first augmented reality app, as part of the launch of a major new arts and culture series.**

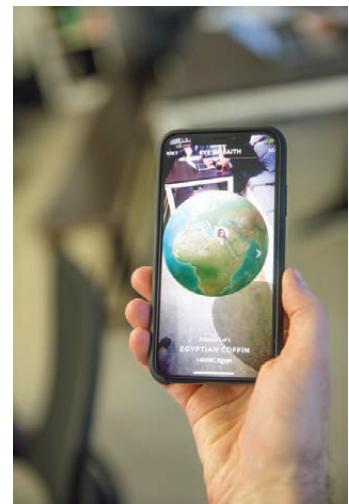
The new app under development by BBC R&D and Nexus Studios will enable people to explore a personal, virtual exhibition from the comfort of their living rooms.

The R&D team has digitally scanned artefacts for the virtual exhibition, and will feature exhibits from museums across the UK, like an ancient Egyptian mummy from the Torquay Museum. The exhibition will

update with new artefacts each week of the show, with new pieces that highlight the themes being explored in the series each week.

At the heart of the experience is a core 'magic spotlight' feature, allowing users to uncover annotations, audio and imagery that enrich the story of each exhibit. Other features will include X-ray, which enables users to see through or inside an object, such as seeing through a sarcophagus.

The app, which will be available for iOS and Android from the beginning of the new series, is part of a



major collaboration between the BBC and more than 30 museums from across the country.

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**Research in brief****SpaceX to enter satellite broadband market**

Elon Musk's SpaceX looks like it plans to muscle in on the nascent satellite broadband market involving non-GEO fleets. The is launching a Falcon 9 rocket with two test satellites for a proposed global ISP network comprising 4,425 satellite. This could rise by a further 7,500 satellites if the V-band is also used. FCC chairman Pai approved the proposal after SpaceX submitted an application to the FCC for clearance. Over the past year, the FCC has approved requests by OneWeb, Space Norway and Telesat to access the US market to provide broadband services via LEO satellite technology that holds promise to expand Internet access in remote and rural areas globally.

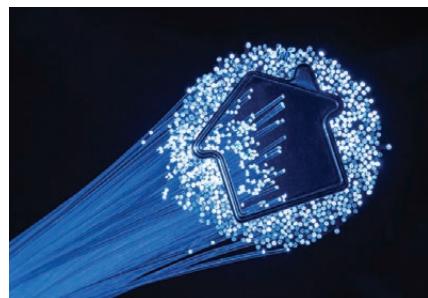
**Big-3 SVoD originals spend**

By 2022, the amount invested in originals Netflix, Hulu, and Amazon Prime Video will triple to \$10 billion annually, according to a new report by The Diffusion Group. The Big-3 SVoD players, as TDG calls them, are shifting an increasing percentage of their content budgets from licensing third-party films and show to originals to win and retain new customers. Much like HBO, the Big-3 now have a much better understanding of licensed content and originals.

**Legacy payTV continues to shrink in US**

**A “perfect storm” of long term trends has led Kagan to significantly upgrade its forecast for broadband households without legacy payTV. Traditional multichannel penetration will fall to the low 60% range at in 2022.**

Shifting consumer behaviours will lead to broadband-only homes, or households without a traditional multichannel video package but a subscription to wireline broadband, to almost double,



according to Kagan, a media research group within S&P Global Market Intelligence. Broadband-only households are set to grow from 19.0 million in 2017 to 37.2 million by 2022.

Broadband-only homes are set to take up 29.2% of US occupied households by 2022 and Kagan expects traditional multichannel penetration to be in the low 60% range at that time.

The analyst firm expects 38.4% of the combined residential cable and telco wireline broadband subscribers in 2022 to forego legacy multichannel distribution and rely mostly on a combination of broadband and over-the-air broadcast signals for home

video entertainment.

“A perfect storm of long-term trends including increase in streaming content suppliers, widespread utility-like status of broadband, and a demographic shift attributable to shrinking baby boomers and rising millennials, is yielding higher broadband-only home gains than initially anticipated, prompting a significant upward update for our projections,” said Tony Lenoir, Senior Kagan Research Analyst at S&P Global Market Intelligence.

It’s not all bad news, however, at least not for operators that offer video as well as broadband. By 2020, cable will count more than 70 million broadband customers. The sector’s video subscriber count peaked at 67.1 million in 2001.

**Linear OTT on the rise in Europe**

**The number of European linear subscribers paying for over the top TV services reached 7.4 million, says new research.**

According to Dataxis latest research, linear OTT Pay TV market in Europe reached 7.4 million subscribers at the end of September 2017, which represents a growth of 13% compared to the previous quarter.

The number of Linear OTT offers has been increasing over the last few years, driven primarily by the growth in specialised sports and kids’ content, the analyst firm said.

Over-the-top sports platforms, such as Bein Sport Connect, Eleven Sports and Dazn managed to attract a significant number of sports fans.

These OTT sports services represent around 25% of the total Linear OTT subscribers as of Q3 2017. Western European countries are leading the sport OTT market with Germany (35%), France (25%)



and the UK (15%).

Wassana Sengsavang of Dataxis added that as sports events are a key driver to TV subscription, it is still to be seen whether this growth will continue at the expense of the traditional pay TV offer.



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## EXPANDING THE DIGITAL OPPORTUNITY

It is undeniable that consumer viewing patterns are changing. In addition to the technical challenges necessary to address these changes, there is a growing realization that the business models that drive broadcasting require revision as well. How does a modern broadcaster adapt to these trends? With this year's theme of 'Expanding the Digital Opportunity', DVB World 2018 is the perfect platform to address the global issues facing broadcasters today.

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# What GDPR means for the TV and broadcast industries

Are companies within media & entertainment rising to the challenge of achieving compliance, and what might be the longer term consequences of this new regulation, asks David Adams



**W**herever organisations store personal data – including within any company in the broadcast and media industry – the EU Global Data Protection Regulation (GDPR) is currently a cause of anguish and expense.

Compliance with the regulation, which comes into force in May 2018, is difficult. Yet organisations found to be in breach of it face potentially huge fines and are also at risk of significant reputational damage, because GDPR speaks to one of the great sources of paranoia in the digital age: the storage and use, or misuse, of personal data.

Any company that deals with consumer data in any way, on any device must comply with the regulation,

which builds upon principles already enshrined in some existing data protection rules. It defines personal data as information relating to any identifiable individual, including location data, IP addresses and other online identifiers. The definition of “sensitive data”, which already included information on health, ethnic origin, and political or religious views/activity has been extended to include genetic, biometric and sexual orientation data.

Organisations that collect data from EU residents are defined as data controllers under the GDPR. They face new requirements relating to the way they word privacy notices; and to the process of obtaining consent from individuals for use of their data.

Consumers’ rights will be enhanced, including the right to have personal data erased and to have data returned to them or transferred to another

organisation on request.

The GDPR also includes new minimum requirements for record-keeping relating to data processing, whether carried out by the data controller or any other company that processes

data on its behalf (the “data processor”). Data controllers are required to conduct data privacy impact assessments and to appoint data protection officers to oversee design and implementation of GDPR-compliant data policies, processes and systems. New products and services should now be designed with data protection risks in mind, using the concept of Data Protection by Design – a change that has significant implications for the TV and broadcast industry.

Organisations will also be required to notify data breaches to regulators within 72 hours of detection; and they must notify individual data owners if the breach poses a high risk to their wellbeing. Such notifications will have to describe in clear, plain language the nature of the breach, its potential consequences and the actions being taken to mitigate its effects.

Regulators will have the power to impose fines of up to EUR20 million or as much as four per cent of total worldwide turnover on any organisation in breach of the new rules. Enforcement measures can also be imposed on companies or organisations based outside the EU, such as preventing them from conducting any further processing of data related to EU residents.

While it remains to be seen exactly how this will work in practice, it also seems almost certain that non-EU member states in Europe and a

growing number of countries elsewhere will pass similar legislation in the near future.

"Every company that processes data is going to have to comply with these obligations," says Stephanie Iyayi, a director at the risk consultancy Convergent Risk. "The industry as a whole is going to have to tighten up its best practices. The entire supply chain will have to comply with these rules."

At the same time, businesses providing services within the EU also need to keep an eye on the slow but steady development of the EU's ePrivacy Regulation. This is currently only a much-debated draft proposal, but it will eventually have an impact on any company providing electronic communication services – and a major impact in some areas, such as the use of digital advertising strategies.

### Attaining GDPR compliance

There is no defined step-by-step process that will guarantee GDPR compliance. Companies must instead work on implementing strong controls on the definition, use or movement of, and access to, data; ensuring explicit consent for use of personal data is obtained from consumers and that their requests around data deletion erasure and/or transfer are fulfilled.

Pascal Charmot, senior business analyst at Nagra, points out that for many companies simply finding and identifying data poses a major challenge, particularly if IT infrastructures are complex and fragmentary.

Obtaining informed consumer consent to data use is one issue that will create difficulties for many companies. Oded Ben Zur, product manager at Kaltura, believes the best way for broadcasters, operators and other content providers to obtain it will be through offering service enhancements as an incentive.

"Once you provide the right incentive for the user, hopefully most will agree," he says, while noting that it will then be

up to the companies to ensure that all their back end systems and the work of data processors comply with the terms of the consent granted by individuals.

Charmot highlights the need to put processes in place to ensure the individual's rights to request erasure or portability of their data can be upheld within all of a company's IT systems, including payment gateways and recommendation systems. But he also suggests that organisations should be aiming to provide transparency, to help individuals understand and feel more comfortable about the data relating to them that a company has and how it is used.

Iyayi agrees that attaining GDPR compliance will be difficult for many companies, as they try to improve data management practices and to meet new requirements such as the obligation to notify regulators of data breaches within 72 hours. But she also believes that the process of working towards GDPR compliance should deliver business benefits, as organisations draw greater value from the consumer data they have.

Whether companies will actually be able to take advantage of that opportunity is another question. There is general agreement among industry observers that the level of GDPR readiness varies from one company to another.

In theory, organisations with more resources that are based in countries that already have strong data protection rules in place should find achieving compliance relatively straightforward. But Peter MacAvock, chairman of the DVB Steering Board, does not believe this has been the case in practice. "If you can find an operator or another stakeholder in the industry for whom this has been straightforward then I'd love to meet them!" he says. "It's been a huge pain for many of the people we've spoken to about it."

In some companies the process of attaining compliance has also led to lively internal debate between business

leaders, technology experts and lawyers as to what exactly is required. Clearly, some companies will try to find a way to do no more than the minimum required to reach a level of control over data that can be seen as being compliant with the regulation.

Others will seek to achieve or go beyond best practice. Nina Barakzai, group head of data protection and privacy at Sky, defines the aim of her company as ensuring that personal data is handled "fairly".

"This means processing it in a way that enables the business to gain insight to better serve its customers, while protecting individuals from their data being used in ways they don't expect," she explains.

"For individuals, it makes sense to give your data to an organisation in which you have confidence and who you think will take care of your personal data. With the new legislation, the challenge for organisations is to capture the evidence that this is happening consistently throughout the commercial journey.

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**"If you can find an operator or another stakeholder in the industry for whom this has been straightforward I'd love to meet them. GDPR has been a huge pain." DVB**

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"As we deepen our interaction with our customers, employees and stakeholders, through our news and broadcast content, online and through social media, we face the challenge of handling ever increasing amounts of

data. We must make sure we use that data [the way] we originally said we would use it."

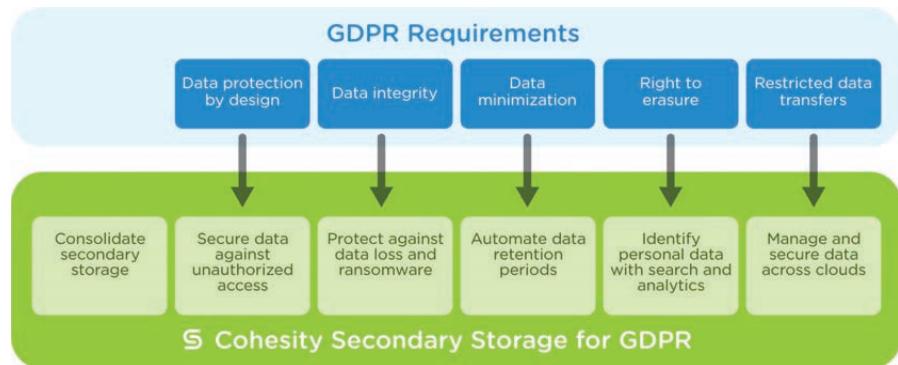
### **European efforts and initiatives**

Companies with a multinational presence are more likely to be among those organisations able to dedicate the most resources to GDPR preparations. One such company is RTL AdConnect, which works with over 100 TV channels and associated catch-up/digital services, mostly free-to-air, in 12 markets.

"GDPR has a big effect on us and our industry, because it affects the contact possibilities for advertisers with consumers," says RTL AdConnect marketing director Daniel Bischoff. "What we have been trying to do is find ways of giving the user more opportunity to have control of their data, but also making things easier for the operator." He explains that some media companies within the RTL group have formed new alliances to provide better targeted advertising through pooling the personal data they have, within a grouping in France called Gravity; and another in Germany, the Log-In Alliance.

Equipment, software and services providers are also working hard to achieve compliance. Christine Maury-Panis, executive vice-president and general counsel at Viaccess-Orca, says her company is working through the process of ensuring compliance in relation to its own data and in support of the clients using its software, including recommendation engines, DRM systems and content protection technology.

"These systems, particularly if our customer requires that we operate them for them, bring access to personal data," Maury-Panis explains. "We have to demonstrate that our software is designed in a way that allows any owner of personal data to agree that we can use it, but also so that any time they want access to it they can get it, that it can be rectified if it is wrong; and we



must be able to transfer it elsewhere."

GDPR also poses problems for the many companies working in the industry that are based elsewhere but process data related to EU residents. "If you process personal data for entities in the EU you are captured by this regulation," Iyayi warns. "If you have customers in the EU you have to comply with these regulations. The fines will apply to you as well."

"One of the powers that the regulators have is to stop the transfer of data to those entities – which means their business ultimately stops. And ultimately, of course, if you're not compliant there's a risk to your customers, which means there's a risk to your reputation."

### **GDPR can have many positive business effects**

There is also the fact that GDPR-like regulations are certain to follow in many other countries. "It's a global industry," says DVB's MacAvock. "While the EU are being seen to take a lead in this area, there is no doubt that the whole of the industry, no matter where a company is, will be impacted by this."

Kaltura's Oded Ben Zur says he has seen some activity related to the GDPR among TV operators and service providers operating in other parts of the world, including the Americas and Asia-Pacific, but there remains a perception that the regulation will be harder to enforce in these markets.

"I guess operators in the rest of the

world will take their time," he says. "They may make some more enquiries after there has been a big fine issued."

As for the possible longer term consequences of the implementation of the GDPR, Maury-Panis fears that a tougher regulatory regime could discourage partnerships between technology companies and content creators, broadcasters or other service providers. "My concern is that operators will be reluctant to give access to the personal data of subscribers," she explains.

But others insist the GDPR offers opportunities for differentiation and to improve services for B2B clients and for consumers. "Having to appoint a data protection officer, having to work on the basis of privacy by design, the provisions of the regulation and the fines provided for – all this will incentivise a better approach in the industry," says MacAvock.

Charmot believes GDPR will offer a new way to boost customer loyalty and perhaps even to attract new customers. While the threat of lasting damage to brand reputations caused by a data breach, or by data being mishandled in some other way is real, there is also a genuine opportunity to build a reputation for using data in a safe way to provide additional benefit to the consumer as well as the service provider.

As Charmot says, "It's about trust." For companies able to prove themselves worthy of that trust, the GDPR may yet prove to be a blessing in disguise. **cs**

# The changing face of premium mobile video viewing

And the growth of “offline subscription VoD users”

**T**he last five years have seen a melting pot of digital content consumption drivers create a plethora of video options for consumers, with OTT video viewing becoming a mainstream activity. These have also provided a stimulus for changing behaviour in mobile video viewing in the context of wider connected hardware uptake.

Significant improvements in mobile infrastructure in recent years have enhanced mobile video delivery, but it could be claimed that 4G is somewhat of a red-herring for mobile video usage. This is particularly notable for longer-form content, as Futuresource's previous research indicated - most data heavy video viewing on mobile devices uses WiFi networks rather than cellular networks. 3G/4G networks tend to be better suited to short clips and snacking, but data caps and constraints remain restrictive for the mass market when it comes to longer form viewing.

It is a different scenario in the home, the impressive growth in subscription VoD and other paid-for OTT video services, focussed on long form or premium content (including live sports), has seen an evolution in behaviour on connected hardware. There has been much hype in recent years relating to viewing on mobile devices, but the TV firmly remains key for premium video viewing.

Connectivity has driven this surge, either through embedded smart capability, or via third party devices such as digital streamers and games consoles.

Netflix is perhaps the best barometer

of device usage for premium video. Futuresource's consumer survey 'Living With Digital' looks at entertainment service uptake, behaviour and device interaction twice per year. The latest survey highlights that the smart TV was the most commonly used hardware type to view Netflix on; typically over 40% of Netflix users in the key countries viewed Netflix on a Smart TV. But perhaps more importantly, it was easily the “go-to” hardware type, the primary device people used. In the US, for example, almost half of Netflix users view the service on a Smart TV, with four in five of these saying it is their preferred device.

However, typically only around one in four Netflix users view the service on a smartphone, with most of these saying it is a secondary viewing device (only circa 8% of Netflix users said the smartphone was their “go-to” device for Netflix). This preference for large screen over mobile device viewing for premium OTT is despite significant innovation in screen technology on smartphones. The use of OLED screens in smartphones is now common place, with 4K resolution also gaining ground. According to Futuresource's Mobile Device Tracker, around 40% of smartphone sales this year will be OLED, whilst approaching one in five smartphones sales in 2017 will be over 5.5”. Bezelless displays with an 18:9 ratio are now standard in flagship phones, pushing the boundaries of screens to the next level.

Certainly these screen improvements have benefited from another trend that is contributing to the changing dynamic of mobile video viewing - the emergence of “offline” downloaded viewing of subscription services. This feature has

been available on Amazon Prime Video and some Pay-TV “Go” services (e.g. Sky Go Extra) for at least two years, but Netflix only belatedly launched this feature

at the end of 2016. This activity is mainly driven by out-of-home use e.g. commuting, kids travel, holidays etc on smartphones and tablets.

The feature has quickly become widespread; according to Futuresource's latest Living with Digital survey, 43% of Netflix users in US and EU5 occasionally or regularly use the offline downloading functionality, whilst awareness of the feature is at over 70% of users. Usage of the functionality amongst Amazon Prime Video viewers is even higher than for Netflix, partly due to the wider overall Netflix user base and that the feature has been available for longer on Amazon Prime Video. In these same territories, 18% of overall respondents are “offline SVoD users” of either Netflix or Amazon Prime Video; to put this into context, this is over twice the number of people who are Spotify premium subscribers and approaching the same figure of those who take a Movie package on their Pay-TV service.

Perhaps this figure is of more significance, as this is typically complementary to in-home viewing, less of a second screen activity and not impacting big screen viewing. So as premium OTT video continues to evolve, perhaps it is more about the situation, not the device, that defines the video viewing experience. **cs1**



**David Sidebottom** is Principal Analyst – Media and Entertainment, futuresource

# 1

## **UHD-HDR to benefit from sports boost**

What a difference a year makes. Consumer demand for UHD and HDR content has increased exponentially over the past 12 months.

Recent Ericsson ConsumerLab TV & Media research shows that 4K/UHD TVs are now present in over a fifth of all homes, demonstrating the increasing demand for televisions with higher picture quality. This, in turn, placed additional pressures on broadcasters and TV studios to improve their delivery infrastructures and transmission of their content.

DIRECTV has already started the broadcast of NHL and NBA games in HDR, and its streaming service DIRECTV Now will also support 4K and HDR in the near future. The Pyeongchang Olympics are expected to be broadcast in UHD-HDR, with South Korea being the first country to deploy a terrestrial system (ATSC 3.0) that supports the next-generation resolution. In addition, the FIFA World Cup will be available in HDR with different resolutions and flavors to also accommodate HD-SDR legacy systems.

"2018 is the year that UHD-HDR will take off," says Thierry Fautier of Harmonic and President of the Ultra HD Forum.

While there are certain issues to work out, such as reaching an agreement for a universal HDR specification, HDR broadcast content availability will increase this year, Fautier promises. Moreover, the infrastructure will evolve, he says, thanks to the newly released SMPTE ST2100, making UHD-HDR content more seamless to deploy.

HDR, along with HFR and WCG enhancements will become default in the near future, as far as display capabilities are concerned, believes, Sanjay Mittal of Interra Systems. This is, in turn, going to push the market of software solutions required to streamline UHD-HDR media broadcasting workflows.

# 2018 predictions

**With the year getting off into the swing of things, CSI looks at the key trends we can expect to see in the coming 12 months and beyond**

## **2. New interactive content: Silicon Valley players bring new gifts**

An interesting prediction from Kieran Kunhya of Open Broadcast Systems sees 2018 bringing more innovation from Silicon Valley players beyond just delivery.

Whilst there has been much hype in previous years about live video from these players, most have been retransmitting the same signal as on television. This year, however, should see them experimenting in producing content differently with their experience in machine learning and their vast amounts of data about consumers.

"We will start to see these platforms having much more interesting and interactive content, giving consumers a real reason for watching the web versions vs on the TV. This may even go as far as bidding on multibillion dollar sports rights and producing them in a different way to broadcasters," says Kunhya.

"I think it is safe to say that there is a lot of unused potential for broadcaster to enhance their offerings and by allowing users to embrace interactive offerings, agrees Kjetil Horneland, CEO and founder, Sixty. This is particularly true of sports content."

This year we will see the industry embrace on-screen graphics and the concept of making TV content itself 'viewer clickable' on all devices, with the provision of up-to-date data, infographics, purchasing options, gamification, and seamless interaction with social media platforms - all in one packaged experience for the end user, according to Horneland. "As a result, we predict that the viewing experience

will see gaming, TV, social and data services merge into one delivery system, as well as it will make TV more personalised for each user."

Adding to this theme, following on from the launch in the US, Dan Finch of Simplestream expects Facebook Watch to conclude more deals with broadcasters and production companies to deliver highly personalised viewing experiences where viewers will be able to invite their friends in real time to "co-view" with them. This will appeal to both the content owner who will be able to monetise their content, benefitting from higher paying CPMs than that of TV and for the user who can then elevate their own social status within their social network.

## **3. Cloud maturity**

Over the past year or so, the core technologies of cloud have stabilised, cost models have become better understood, and the array of third-party technologies and services has matured. Even while core cloud services are still evolving, the surrounding cloud ecosystem is maturing.

To date, Amazon Web Services has defined the entire cloud ecosystem. But as the ecosystem matures, so will demand for improvements to existing tools and for more customer-driven features, according to Seth Noble, CEO, Data Expedition.

"There is a growing pool of technologists who have survived multiple cloud deployments and now know what questions to ask and where to get answers. That experience is critical to reducing the unknowns of cloud adoption and bringing efficiency

to what has been a chaotic process," says Noble.

Key areas where Noble thinks we will see meaningful change in 2018 are: data transport to the cloud (hardware vs direct connect vs accelerated internet), data storage (object vs file vs database), and application deployment (lift-and-shift VM vs SaaS, vs pure serverless). "All of these are areas where I've seen hidden costs and functionality tradeoffs create havoc in the past, but where I believe experience and more sophisticated product offerings will improve stability and value for everyone."

Jon Morgan, CEO, Object Matrix, foresees an emphasis on integrated, hybrid cloud workflows to plug gaps and an explosion of third-party companies offering services both for on-premise and the cloud. "I predict the clouds will clear and it will be used increasingly, but in more relevant workflows. Other workflows that were rushed on to the cloud will be moved back off. The long-term cost of the cloud will bite hard, and those who invested early may find cost efficiencies

haven't materialised."

"In 2018, we expect more broadcasters to advance towards cloud and virtualization technology to enable more agile operator experiences and reduce infrastructure complexity, throughout the entire video delivery chain," adds Mark Russell, CTO & Head of Strategy, Ericsson Media Solutions.

#### 4. AI everywhere

Or rather, AI hype everywhere. Expect companies to jump on the AI bandwagon claiming to have AI inside. True AI - as opposed to just machine learning algorithms that analysts at CCS Insight refer to as "pseudo artificial intelligence" - will take a while to crystallise. To be fair, there is a lot of very interesting experimental and real-world work going on in this area, including how it relates to broadcast and video, but it's not there yet.

Historically, artificial intelligence technology has largely been concerned with voice and text data, but recently, AI tech has increasingly been applied to

video content.

"That's not surprising given that it makes up 70% of the world's data," notes Morgan of Object Matrix. "When applied to video content AI has been steadily improving the way we tag, search and discover content. And, given the pressure to maximise the value of content, AI has the revolutionary potential to lead to the rediscovery of thousands of assets we never knew we had. Naturally, content that is easier to find is easier to monetise, so anyone who owns data should be excited by the prospect of AI/video intelligence".

AI processing will also increase the level of sophisticated metadata stats available to storage users, he thinks. With this metadata, it may be possible to build highly detailed profiles of users and push content based on the patterns provided.

"In 2018, Artificial Intelligence will play an increasingly more meaningful role across the in the media and entertainment landscape. This is particularly true when it comes to personalisation," adds Rajeev Dutt, founder and CEO of DimensionalMechanics. AI will enable better use of data and metrics used to help deliver more targeted content, powered by better analytics. This will be coupled with the role of AI in ad tech for targeted ad selection to better serve consumers and advertisers. AI will improve relevance, in terms of content and advertising, and help reshape the businesses of Pay TV providers, broadcasters, content creators, and their suppliers in 2018 and beyond.

Apart from QC tasks of content classification or object classification, machine learning and AI will also be instrumental in some of the routine activities of media professionals like colour grading, editing, and video indexing, according to Sanjay Mittal of Interra Systems.

Longer term, machine learning and AI are predicted to begin to transform all areas of OTT, with advertising,



content insights, recommendation engines and content delivery becoming intelligent, according to castLabs. Data exchange is key, so video delivery infrastructure components will need to provide integrations with external services to tap into AI.

Away from video, AI ethics and machine (data) bias is a fascinating area that will evolve in 2018 and well beyond this year.

### 5. Gigabit access

Gigabit speeds to the home are the new strategic objectives of most operators in access environments. Fibre installation is marching along at an increased pace and is pretty much on all operators roadmaps, if not already in trial and deployment.

"Access is the hot part of the network right now and has everyone's attention. Use of existing wiring, particularly coaxial cabling, as part of the overall access portion of the network, will prove to be a much used and rediscovered new best friend," points out Rob Gelphman, VP of Marketing and Member Relations MoCA.

The immediate issue and challenge in the next few years will be to determine the best fibre extension technology standard that guarantees one gig with a roadmap toward greater speeds.

Additional requirements include ever lower latencies, enhanced QoS and security among many others.

Symmetrical performance will also be a requirement going forward.

### 6. Embracing third party apps

It has now become clear, to a critical mass of operators, that they need to present a unified view of all the content available, and to enable search and intelligent recommendation, regardless of content source.

"Now operators understand that, mainly thanks to Google and its operator-friendly Android TV proposition, third party apps and content can be proposed to viewers from within the operator-branded



ecosystem," argues Kai-Christian Borchers, Managing Director, 3 Screen Solutions. "We believe a big development for 2018 is that operators will truly embrace third party apps and welcome them onto their platforms as part of a holistic service offering. This was technically possible with RDK, and Linux, but it took Android TV to bring about real change."

Integrating third party apps into the broader pay-TV service offering is a trend which will help operators defend against cord cutting, while viewers get more choice and convenience.

### 7. The 'return' of the STB

The death of the STB has been predicted for many years and yet they refuse to budge. The market, in dollar value, is on the decline, but volumes if anything are growing.

There is a strong trend now for the STB and OTT to grow together, side-by-side, in the system's front end. In 2018, OTT providers and their viewers will both benefit from this convergence with 'traditional' STB technology.

It turns out that with the declining unit costs for STB, lower cost technology system options to power those boxes and with the emergence of new powerful client technologies like Android TV, operators are seeing STBs which are fully controlled by them

as a key competitive edge against the independent video service providers in their markets, according to Michael Lantz, CEO, Accedo.

"It is proven that consumers with operator-powered STBs are less likely to churn, which essentially pays for the STB solution in itself. With continued decline in costs and improvement in quality for 4K TV screens, consumers demand attractive living room video devices, aka STBs," says Lantz.

### 8. Blockchain will change distribution models

Blockchain is now as much discussed and hyped as AI or VR. As momentum builds, 2018 could be the year where blockchain really adds value to VoD services, thinks Ostmodern. The company thinks the value of blockchain in VoD will emerge in how it can powerfully manage and track the rights of content.

"Blockchain, with its secure, decentralised network, will allow creators to track and monetise their content, while building a direct relationship with their audience. Although it is still an emerging technology looking for its place in industry, video providers should be keeping an eye on blockchain to see how it might impact their business," says Ostmodern's Tom Williams.

## 9. How relevant is SMPTE ST 2110?

2017 was the year of innovation and learning for IP in the media environment, especially given the approval of key parts of the SMPTE ST 2110 standard and the development of protocols that will be used to ensure a seamless migration from SDI to IP. SMPTE ST 2110 is set to become the de facto standard for the migration.

"In 2018 we will see real-world solutions that leverage the standards and specifications to not only enable the transition to IP, but also add greater flexibility and accessibility to media over IP infrastructure," says Andy Warman, Director of Playout Solutions, Harmonic and Board Member and Marketing Working Group Chair, AIMS.

But not everyone is convinced. "The advent of the SMPTE 2110 standard has been repeatedly promised as the future of IP in a television studio. Yet the standard doesn't cover the long-term challenges that the broadcast industry faces; it is essentially there to support the short-term goals of traditional hardware manufacturers," argues Kunhya of Open Broadcast Systems.

These standards bodies are proving slow to understand the challenges the broadcast industry faces against the software-centric players in Silicon Valley, he thinks. The example of the Alliance for Open Media developing the AV1 video codec planned for release in 2018 will pit modern development practices against decades of thinking from traditional standards bodies.

## 10. The compression problem

On that note, the EBU commissioned the University of Applied Sciences of Wiesbaden to carry out a subjective evaluation of competing video compression technologies, including the royalty-free AV1, JEM and HEVC. The evaluation will include a comparison of the speed of the encoding/decoding and is designed help EBU members choose the best codec for their individual needs.

With such bitrate dense video traffic, there is intense debate around which codec will be best suited in dealing with a global audience of 2.8 billion IP-enabled consumers who expect TV experiences on any device and increasingly UHD video content.

"We believe the industry will move away from the inherent belief that there is a single solution to the compression problem and that it needs to be a direct replacement to the current MPEG standard," says Harmonic's Fautier.

Fabio Murra at encoding startup V-Nova agrees. Instead, he points out that the TV & media industry will use the codec that best suits the application with the least compromises, deployment and maintenance cost. "Finding out exactly what makes the service valuable to the viewer - whether it's lifelike texture in UHD video, simple images delivered live over a congested 3G mobile network or stills that offer minute detail - will drastically change the way we approach video compression in 2018."

## 11. And some more...

**Cloud playout.** 2017 is the year that cloud became ready for primetime and it is expected that the number of cloud playout deployments grow in 2018.

"We've seen major broadcasters adopting cloud-based infrastructure for multichannel playout. The feedback we've had from our customers is that they feel increasingly confident that cloud can support their business and operational strategies for new and existing services" notes Neil Maycock at SAM.

**OTT latency.** 2018 will be the year that pay-TV operators tackle latency issues for OTT, predicts Jacques Le Mancq, CEO at Broadpeak. Generally, for live streaming, there is a delay of about 30 to 60 seconds compared with only a few seconds on broadcast and IPTV networks. Since consumers can communicate news and information in near real time via social networks, it's important to have low latency for live

content, especially sports events. Using multicast ABR technology combined with chunk transfer encoding and CMAF, operators can solve this issue.

**Multiscreen video delivery via satellite.** Multiscreen video delivery via satellite will take off in 2018 as operators turn to multicast ABR technology for live to multiscreen and push VOD, also thinks Le Mancq. Thanks to multicast ABR, satellite operators can propose live TV and VOD services to all the screens inside the house, including tablets, smartphones, connected TVs, and other OTT devices, by leveraging the end-users' STB. "This will give them an edge on the competition."

**Flexible commercial models.** 2018 will see both successes and struggles as broadcasters of all shapes and sizes find the best monetisation model for their content, including the platforms they use, the way in which they distribute it, and the territories they target, reckons Nick Moreno, director of strategy in the satellite and media business unit, Arqiva. "As a result of this increasingly competitive landscape, broadcasters are demanding flexible commercial models. The potential of virtualised cloud services, where content owners can quickly launch new channels and VOD models, test new technologies and reach new audiences, will be truly realised."

**Localisation.** 2018 will bring greater demand for local content from the creators and influencers that audiences have grown to know and love online, as well as being introduced to talent they haven't discovered yet, according to Curt Marvis, CEO of QYou. "For viewers, what captures their attention differs from region-to-region. TV service providers are realising that you can no longer adopt a "one size fits all" approach when it comes to TV programming."

**VR remains a long-term game.** Standalone VR headsets will launch in 2018, priced \$100-\$250. One challenge then will be to secure content. The pieces of the VR video ecosystem are yet to find their long-term place. **cs1**

# SVoD viewing and content strategies in an increasingly crowded market

By Guy Bisson, Research Director, Ampere Analysis

**L**ike Hoover and TiVo, brand names have often been synonymous with products and services. A few years ago, if you were a US Subscription Video on Demand (SVoD) customer, it was pretty certain you'd be a Netflix customer. That is most certainly no longer the case. Today, Netflix accounts

## for only around 43% of major SVoD subscriptions in the USA.

As more SVoD services launch, viewing time does not increase exponentially. The average time spent viewing SVoD content in US homes, regardless of services taken, stands at just under two hours. So, as more and more SVoD services launch, and more and more customers stack multiple SVoD options into their in-home environment, how does viewing of

each service change?

Looking at the three largest SVoD platforms and their combinations in US homes, reveals some interesting statistics about the future of viewing in a multi-SVoD home. Using self-reported viewing of SVoD

content throughout the day shows that total SVoD viewing time increases as more services are added to the entertainment mix.

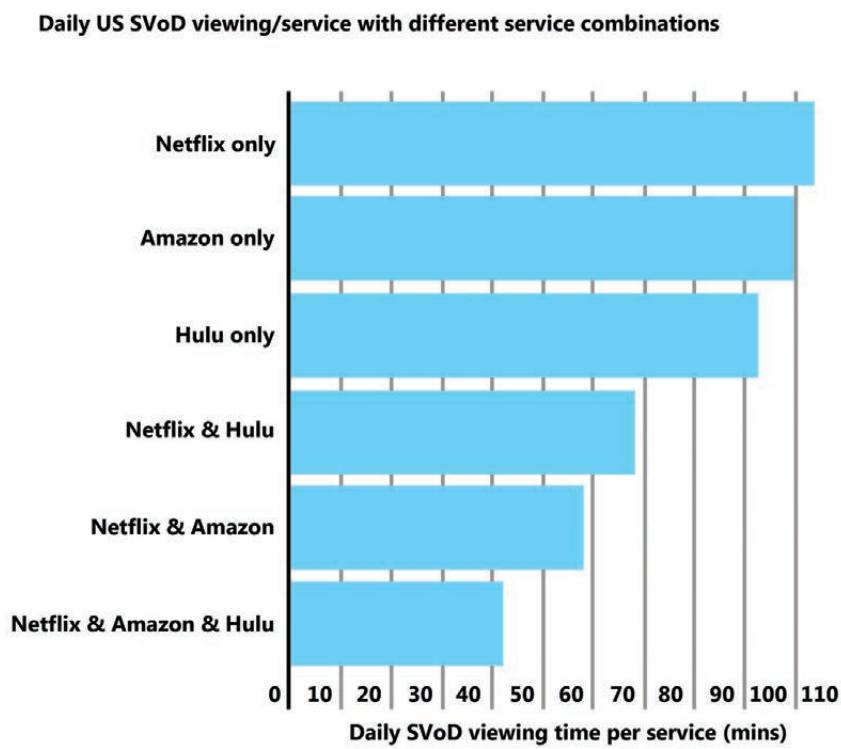
Homes with Netflix and Hulu and Amazon Prime watch two hours and eight minutes of SVoD content a day. By contrast, the average for a home with any two of the services is two hours and five minutes, while homes with only one of the three SVoD services average one hour 38 minutes of SVoD viewing a day.

But while viewing time each day for SVoD clearly increases with more services, the increase is only marginal, meaning viewing time on a per-service basis decreases significantly.

The average viewing time for homes with one service stands at one hour 38 minutes per service; homes with two SVoD services view for 63 minutes per service and homes with three services view for 43 minutes per service. It's not possible to assign the time spent on a specific service within a multi-service home, but we can see which service combinations result in the most viewing.

For homes with only one service, Netflix-only homes watch the most, followed by Amazon only and then Hulu only. But in two-service homes, the combination of Netflix and Hulu results in a higher viewing time than Netflix and Amazon.

As SVoD services increasingly fight for viewer share in homes that have created their own multi-provider SVoD bundle, content diversification and delineation are likely to become even more prevalent than today.



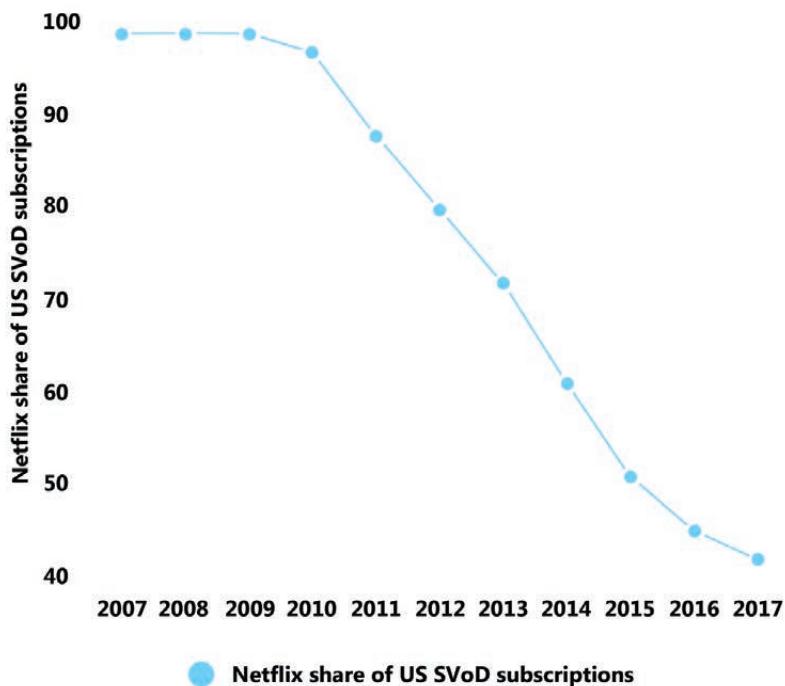
Already SVoD services in the US are aligning around certain key properties and tent-pole titles. While Netflix focuses on a balanced output with original titles like *Stranger Things*, *The Crown*; Marvel's *The Defenders* and *Ozark*, Hulu has focused on an arguably more female focused strategy with originals like *The Handmaid's Tale* and acquired *The Mindy Project*.

In many ways, none of this is new. As the linear channel business evolved with the launch of digital, the competition for eyeballs became increasingly fierce. Brand diversification and specialization was undertaken as channels moved from largely generalist to increasingly specialist. The second key strategy deployed in the linear business was to develop channel families, with brands associated with specific, but often related, sub-genres launched by the same channel owner.

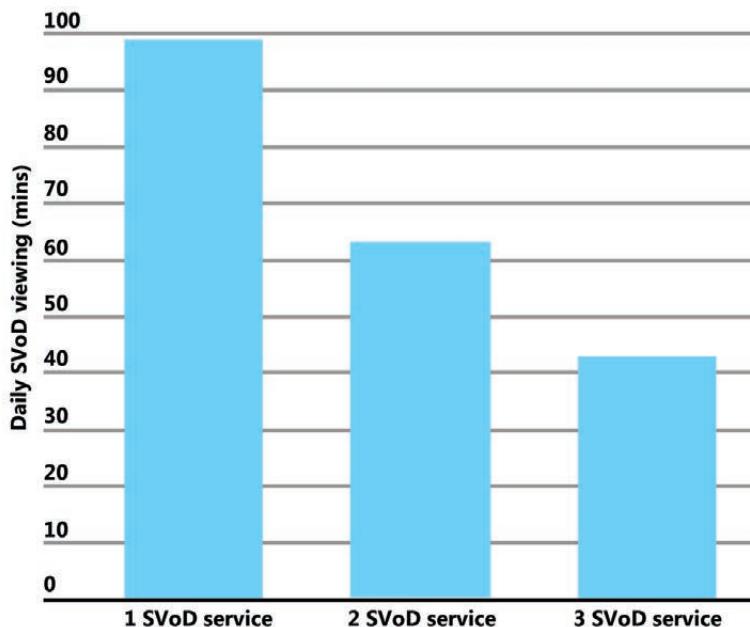
The SVoD market is not yet mature enough to pursue a fully diversified strategy. Niche direct-to-consumer services have yet to gain much traction and, arguably, SVoD as a delivery platform, with its superior navigation and personalization options, is better placed to remain more generalist in content offer. But as both delivery platforms and 'channels' increasingly migrate to SVoD models and streaming delivery, could we soon see a convergence of strategy between the old and the new?

Amazon has arguably already started down this path with its platform partners, but has yet to launch its own diversified brands beyond Amazon Prime. Could a full bouquet of Netflix 'channels' be on the cards in the future? It's an interesting idea, not least because channel family diversification also opens up the potential for business model diversification with a mix of pay (subscription) and free (advertising-supported) services within the same family. **cs!**

**Netflix share of US SVoD subscriptions (major services)**



**Average daily SVoD viewing time in US homes**



# Solving the mobile video optimisation puzzle

The need to optimise mobile video is becoming a key priority as OTT consumption grows. It involves many moving parts, from streaming protocols to more converged networks, discovers Goran Nastic

**J**effrey Katzenberg, a well-known studio executive and former chairman of Walt Disney Studios, is looking to revolutionise entertainment with short-form premium content customised for mobile consumption. The exact details of the venture are unknown, apart from a tentative name of NewTV, but the big idea is that the mobile-first service will target millennials with video series of episodes up to 10 minutes in length - produced with primetime budgets and production values.

"We assume all of our content is being consumed on a mobile device. It informs how we edit our video, how we format our copy and structure our overall programming strategy. Since we are digital/social first, having this sensibility is at the core of our business and every decision we make," said Jeff

Urban, co-founder and president of Whistle Sports, an online sports entertainment network that delivers sports content across multiple social, digital and TV platforms.

These premium mobile-first video services will continue to grow as audience behaviour and industry dynamics change. They bring new monetisation models and also new distribution challenges. As mobile video becomes an integral way for viewers to access and catch-up with the content they want, scalability and also video optimisation becomes a challenge.

The technical aspect should not be underestimated as there are many moving parts to mobile video (no pun intended). Users are often frustrated by buffering, latency, long loading times and other glitches that can ruin the user experience (QoE).

Content owners like NewTV and Whistle Sports will not tolerate poor video QoE as people get accustomed to better quality streaming. Consumer research in the US, Europe and Middle East has found that people will only tolerate around 6 seconds of video buffering before turning it off in frustration - and the majority blamed the operator for poor QoE. Making the point in a slightly

different way, Ericsson has even found that a slow or lagging video created the same levels of stress in viewers as watching a horror movie.

Openwave Mobility research found that today 38% of video on mobile networks worldwide is HD. HD video on mobile networks is likely to be at least 50% of total video traffic by the end of

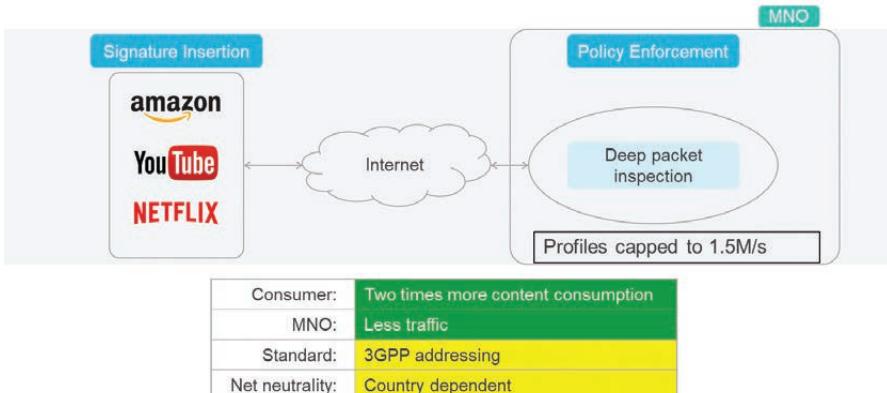
2018. A proliferation of video hardware acceleration in mobile devices has driven this, as has bigger and higher quality displays and mobile cameras.

As many mobile devices already have the benefit of High Dynamic Range (HDR) capability and HD displays, they add further load to the demand on bandwidth. At the same time, it would almost be a shame if these bright high resolution screens suffered from constant glitches in video.

"It's a major conundrum," acknowledges Stefan Blickensdörfer, Senior Solutions Architect, 3 Screen Solutions (3SS). "Viewers want more and better quality mobile video while the mobile network providers face a huge, and increasing, delivery challenge. And at the centre of it all sit the broadcasters, rights holders and multi-channel providers, all trying to get their share of service revenues while striving to keep viewers loyal."

It is worth noting that up to 80% of video consumption on mobile devices takes place over WiFi (in others, like India, cellular rules). Increasingly, optimising mobile video is not just a job for mobile network operators (MNOs), but ties together with online streaming in general. After all, (pure) mobile broadcast has effectively been made obsolete by the deployment of LTE 4G services, combined with CDNs (content delivery networks) that allows mobile video delivery to converge with fixed OTT infrastructures, something that is expected to accelerate as 5G becomes available around 2020.





## 5G to improve video QoE with edge caching and broadcast

Network congestion and the robustness of the mobile network are the most significant factors determining QoS and the viewing experience because mobile network strength and quality continually fluctuate.

To better allocate network resources, deep caching is a recently developed technique. With deep caching, content is served closer to the end-user, which can be achieved by transparent caching where the cache sits in the MNO network, or having edge computing caching (MEC ETSI standard). Multi-access edge computing is a new technology that allows operators to open their Radio Access Network (RAN) edge to authorised third parties.

MEC is part of the 5G specification and will start to be deployed in 2020. The new standard is expected to allow caching in locations closer to end-users,

possibly in base stations, according to Nivedita Nouvel, VP Marketing at Broadpeak.

It is possible that eMBMS technology for broadcast delivery on mobile networks may take on a greater role. With 5G, the new standard would enable content providers to allocate dynamically eMBMS and multicast resources based on the context of the end-user device capabilities in terms of content reception, whether in the home network or on the go, suggests Nouvel.

Broadpeak are an active participant in several H2020 projects about the future of mobile TV, as defined by 5G. The projects it is involved in are Sat5G, focusing on satellite video delivery in a mobile context, and 5G-xCast about convergent solutions between fixed and mobile networks. These cover contribution to base stations, caching closer to end-users and multicast/broadcast resources allocation.

Incidentally, ATSC 3.0 also aims to unify broadcast and broadband delivery.

The high bandwidth and low latency of 5G together with MEC should prove useful for future applications like VR/AR, and 4K/HDR/HFR in live events.

## Encryption and the rise of HD

For the time being, it is the rate of HD content growth that has taken MNOs by surprise. As has the volume of encrypted traffic.

The rise of encrypted traffic by app and content providers has raised concerns about MNOs visibility into their networks and thereby the ability to manipulate and optimise video.

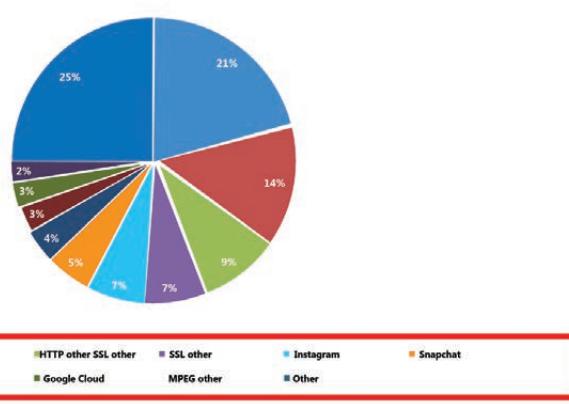
Estimates have Facebook, Amazon, Netflix and Google (FANG) controlling 70% of total Internet traffic, contributing to the fact that 75% of all mobile internet traffic is now encrypted. According to the latest MVI report by Openwave Mobility, this figure is predicted to grow to 90% by the end of 2018.

Now, network providers face a two-pronged OTT battle in the shape of HD and encryption. And this is impacting QoE and operators are losing control of their networks.

As the CTO of OpenWave Mobility argues later in these pages (see p34-35), new mobile data management technology can identify and differentiate traffic streams and intelligently adjust encrypted ABR for videos and reduce the impact on the RAN, while delivering superior QoE to subscribers.

"Given the unconventional TV revolution sweeping the globe, network operators can no longer rely on conventional optimisation to stave off the OTT onslaught. OTTs will continue to launch salvos in 2018 and beyond in the form of increased encryption and petabytes of new HD content," writes Matt Halligan in his feature.

Major players like Google, Netflix, and Facebook can optimise video delivery on mobile networks because they have deployed their own servers in the infrastructure of operators. The



Source for charts: Harmonic

Google QUIC and Facebook's 0-RTT protocols are identified as two of the main reasons why encrypted traffic has grown as fast as it has.

As the market for mobile video caching and optimisation heated up, a range of companies emerged, like Mobicell, Saguna, Vantrix, Avassi, Citrix Byte Mobile and Flash Networks, some of which have been acquired by larger players.

"In the past we have seen a lot of 'video optimisation companies' doing rate shaping, transcoding or rate pacing. However, with the arrival of DRM/ HTTPS, content is now encrypted and simple adaptive bitrate (ABR) playlist manipulation techniques, such as the one applied for zero rating, are becoming the norm," says Fautier.

Although encryption may make the payload "dark" to the operator, it is still possible to identify the application a subscriber is using, and determine whether or not video is streaming within that application - The Open Web Alliance is among those working on this, according to a white paper by TMN for Rohde & Schwarz's ipoque business unit.

### Compression efficiency

Data from Conviva suggests that viewers watch 250% as much video when there is lower buffering, quicker start times and higher bitrates. Compression efficiency and reducing the bandwidth play a key role in this.

"The choice of codec defines the capabilities of the compression, and additional tools can adjust the video to optimise the colour-range and other attributes to allow a bigger compression. Choosing the right chunk-size and optimising start-chunks helps with faster delivery," says Blickensdörfer at 3SS.

Modern codecs like HEVC and VP9 improve efficiency and allow fast compression and decompression. With Samsung and Apple now supporting HEVC on popular handsets, HEVC can be used on nearly one smartphone out of two. There is also now much more

### Video players & DRMs: light at the end of the tunnel

In today's multiscreen world, consumers access content from many screens, mainly from mobile devices with completely different technical and commercial requirements.

As Stefan Lederer, Co-Founder and CEO of Bitmovin notes, this added layer of complexity can lead to inconsistent user interfaces and requires engineering teams to spend extra time maintaining each of the platforms.

"To solve this challenge, operators and service providers can use a unified API and configuration for players to keep all the controls in one place," argues Lederer. This then reduces time spent developing, testing and maintaining user interfaces for each platform.

Integrating SDKs which dynamically measure, analyse and report on quality and performance of the network and handset is all the rage at the moment. This, for example, allows the playout mechanism to select on-the-fly which CDN to use for best-possible

hype around AOM's AV1 codec since Apple joined at the start of the year.

According to Fautier, content-aware encoding, which the company's EyeQ solution uses, further reduces the bitrate, while preserving the quality.

"Based on commercial deployments with operators, we have found that 480p30 is the sweet spot for the max resolution that can be delivered to mobile phones and 720p30 for tablets."

Fautier promises that additional compression improvements will come from machine learning, whereby an encoder is able to encode offline on a selected set of representative sequences (supervised learning). "Early results are quite encouraging," he says.

Indeed, there is widespread belief that the adoption of AI and machine learning across all facets of video streaming will enhance ABR efficiency.

transmission throughout the stream for each individual package.

"Customers are often wanting a uniform playback experience across all devices, hence preferring a universal playback suite to different device-specific players. They're also looking for player UI customisation, an optimal fully-featured playback experience," says Thasso Griebel of castLabs, which offers multi-DRM licensing and SDKs.

There is also light at the end of the tunnel when it comes to player DRMs, adds Harmonic's Thierry Fautier. All popular DRMs - Apple FairPlay, DASH, MS PlayReady - are based on AES 128 encryption. The big difference

is the encryption scheme used by Apple (CTR) and others (CBC). As those are incompatible, content providers have to encrypt twice for each piece of content. Recently, both Android and Microsoft have announced support of CTR in the future versions of their player. This will work for future devices, but not for the huge legacy base, notes Fautier.

For example, Thasso Griebel from castLabs points to recent developments using AI and machine learning from the likes of MIT (Pensieve), which demonstrate that companies can be more precise with determining the bandwidth environment over time. There are also likely to be further developments in buffer-based ABR, already incorporated within the DASH.JS framework, according to Griebel (see box on right for more on the buffering issue).

### UC Browser in emerging markets

Chrome dominates the global market global market share, but new research has shown that the UC Browser, owned by Chinese e-commerce giant Alibaba, has more than 430 million users worldwide on the back of emerging markets. According to StatCounter, UC

Browser accounted for 51% of India's mobile browser market over the past year, compared with 30% for Chrome. In Indonesia, another large market with low fixedline penetration, UC Browser led Chrome by 41% to 32% during the period. Apparently, users find that UC Browser works better in countries dominated by low-end smartphones and patchy mobile services.

### **Is there a need to standardise QoE?**

It's hard to come up with objective criteria for defining a "high-quality" video experience and there will always be compromises. Nevertheless, this is currently being discussed inside the Streaming Video Alliance, probably the leading body in the online video space with a who's who of members. 3GPP could also participate in the efforts of the SVA, suggests Fautier; "For the record, the zero rating techniques deployed are all proprietary."

Another group, the UK-focused Mobile Video Alliance, cites several QoS indicators, such as video start-up time, buffering, video resolution and service availability.

The commercial element makes Ericsson's David Price sceptical. "That might be in the "too difficult" area for the industry as a whole. Each service operator knows what kind of quality is needed for different content categories and applications."

Griebel at castLabs, who is on a number of steering committees that are seeking standardisation, including W3C and WAVE, agrees. "We need to improve the minimum standards for video display and processing across all potential devices, something which the industry is currently prioritising for mobile and tablet devices." At the same time adds: "With past experience, accepted standards are challenged and a uniform approach short-lived."

However industry players choose to define a quality QoE, keeping customers happy is paramount. Mobile video challenges are growing, but so are the tricks they can use. **csi**

### **Netflix wants to put an end to buffering: is it mission impossible?**

Like other video providers, Netflix wants to balance the quality of user experience with the cost of distribution. At MWC 2017, CEO Reed Hastings revealed that the company aims to make buffering a thing of the past. "We want to make buffering a relic, when you start to watch video and it buffers a lot."

This will be achieved through codec investments, adaptive streaming, cache servers, global ISP interconnects and other advances, which have resulted in "incredible" picture quality on a 4-5 inch screen at bandwidth of no more than 0.5Mbps. "Now we're down in some cases to 300kbs and we're hoping someday to get to 200kbs for an amazing picture and experience," Hastings said.

The choice of streaming protocols used also has a big impact. They add capabilities such as faster delivery, reducing delay, jitter etc for better video transmission. But something of a transport protocol soup has emerged as a result, with some disagreements as to the relative merits of each one. This has arguably not been helped by the streaming community adopting similar sounding three or four-letter acronyms like HTTP, TCP, UDP, RTMP, DBR, SRT, RTT and so on.

"WebRTC is an attempt to get to the optimal solution. The move by standards based (DASH), ABR streaming and Apple's HLS to fragment file format fMP4 is a positive step to use ABR for seamless viewing but without excessive latency," says David Price at Ericsson Media Solutions.

"Offering content in several resolutions is key. Random access, or the ability to quickly start playback at a given point, is important for the video experience. Here segment length plays a big role in balancing

between efficiency and access."

Eitan Koter, co-founder and co-CEO of Vimmi, thinks chunked HTTP protocols should be discarded, and the adaptive bitrate concept should be implemented on UDP and not on TCP. "What is needed as an ABR mechanism and protocol which handles MPEG-TS over UDP," he argues. Vimmi has developed a low-latency Dynamic Bit Rate (DBR) mechanism and protocol which handles MPEG-TS over UDP. The protocol is enforced by Vimmi's CDN technology and player SDK.

Finally, Broadpeak's Nouvel points to Multipath TCP (MPTCP) as an ongoing effort of the Internet Engineering Task Force's (IETF) Multipath TCP working group that aims to allow a TCP connection to use multiple paths to maximise resource usage and increase redundancy for video delivery.

Akamai, meanwhile, explaining that its CDN will use predictive delivery to improve mobile video streaming, especially for large sporting events taking place this year. These include video acceleration technologies it developed that improve the consistency and throughput of video to viewers, irrespective of local conditions. In recent tests, they reduced buffering by over 24%, and improved throughput by 12.5%, according to the company.

Algorithms in the client which intelligently predict network conditions can further help optimise, as can choosing the right chunk-size or start-chunks/pre-buffering before the user starts the player

Unfortunately, while OTT players are not short of protocols and other techniques to choose from, none of them combine to fully grant Netflix's wish of low latency and high quality without any buffering. As 3SS's Blickensdörfer surmises, "They all help, but buffering is inherent."

# Close to the Edge

Multi access edge computing takes processing power to the extremes of the network, making it possible to stream ultra-low latency, high bandwidth applications to mobiles, is regarded as the next step in the evolution of the (distributed) network. Stephen Cousins reports

**f the future is a place where consumers are able to play high end video games and virtual reality applications on their smartphones; where billions of everyday objects connect seamlessly to the internet; and where driverless cars are able to predict and avoid accidents in the blink of an eye, then it could all hinge on the success of Multi-access Edge Computing (MEC).**

The distributed network technology, which shifts computing power away from the cloud and closer to the end user at the edge of the network, is already being tipped for greatness.

According to the latest Gartner Hype Cycle for Emerging Technologies, MEC is on the verge of becoming an “innovation trigger” (a potential technology breakthrough) with mainstream adoption expected by the early 2020s.

It is seen by many as the next step in the evolution of the network as service providers and vendors look to combine cloud operations with additional functions hosted at the edge. Critically, it offers the opportunity to satisfy intensive traffic requirements with the lowest possible latency, a pressing requirement especially following the launch of 5G in around 2020.

“Edge computing allows services to

be deployed nearer to the user. For some services this is of no advantage – but for one in particular – online TV delivery – it is crucial. As TV is fast becoming the dominant traffic type on networks this will play a major role in edge computing,” argues Edgeware’s CMO, Richard Brandon.

### Micro multiplied

Tal Weinblum, Director of Marketing at OTT video platform provider Kaltura told CSI: “By 2020, there will be 11B connected devices. Edge computing will become essential for delivering next-generation video experiences. While we will still see the core video platform running in a centralised cloud, the ability to distribute certain aspects of this platform to the edge of the network will help deliver an improved Quality of Experience, lower latency, and optimise bandwidth consumption.”

Distributed Content Delivery Networks are already a commonly used to push out certain content from data centres located closer to people’ homes. But edge computing introduces the concept of the micro data centre, a compact unit integrating powerful graphics processors and computers, able to process or store critical data locally. These could be installed at potentially hundreds of thousands of new locations including wireless towers, cable head ends or at

enterprise facilities.

This diversity of network access options available has given popularity to the term Multi-access Edge Computing (MEC), as opposed to Mobile Edge Computing, another commonly applied term for edge computing technology.

MEC development is at an early stage but key drivers behind it are Internet of Things sensors (IoT) and 5G. Edge computing makes it possible to streamline the flow of traffic from IoT devices and provide near real-time local data analysis for instantaneous decision making.

The same speed of response will be critical to the success of autonomous cars, as calculations must be made close to the vehicle, not miles away in a data farm. Research from Intel has shown that self-driving cars will create more than 4TB of data each day, as data volumes grow it will become increasingly difficult to transmit, receive and analyse the data quickly by conventional means.

Edge computing helps circumvent distance and capacity constraints, multiple network hops, and the centralised processing load associated with conventional internet architecture. For network operators this could result in more resilient network operation and enhanced service delivery, avoiding the spectre of content congestion.

Phill Lawson-Shanks, Chief Innovation Officer at edge data centre provider EdgeConneX comments: “Consumer demand for rich content is growing and performance expectations are increasing at the same time, so there is constant pressure on networks to satisfy intensive traffic requirements with the lowest possible latency. The best way to do that is to decrease the distance between Points of Presence and end users.”

There could be significant benefits when it comes to video streaming to mobile devices, says Eitan Kotter, Co-Founder and Co-CEO of CDN services provider Vimmi: “As networks become increasingly virtualised, MEC

offers an architecture on which to develop and introduce new video services that require low latency (sub 10 milliseconds) and heavy data (video) processing at the edge, such as Virtual and Augmented Reality, 4K, HDR, HFR video OTT, and live events."

It's not hard to imagine a scenario in which a 5G subscriber is able to instantly download and watch a 4K-rendered VoD asset on their device. A centralised cloud platform could be used to determine the user's entitlement and type of device, while the edge computing platform prepares and delivers the highest quality content possible.

### **Early movers**

Who will dominate the edge space is anyone's guess, but several players have already entered the fray. Equipment manufacturer Vapor IO has developed a dedicated Edge Module able to support up to 150 kW of critical IT that can be installed "at the base of a cell tower, on the floor of a car park, or other equally exposed locations." In a similar vein, EdgeMicro now offers prefabricated micro data centres that can be deployed at cell towers.

Tower company Crown Castle International is also keen to grab a slice of the market and leverage its vast, well-distributed network of assets across the US, which include over 40,000 towers and tens of thousands of small cell nodes. The firm made an investment in Vapor IO last June and has hinted at initial commercial edge deployments sometime in 2018.

A key proving ground for the technology's development will be an edge computing test zone, due to be launched by AT&T in Palo Alto, California, early this year. The site will provide facilities for developers and other companies to test connected applications such as self-driving cars, AR/VR, and drones. It will initially exploit a 4G LTE connection, but is expected to upgrade to 5G when the final standards and equipment are

ready, perhaps at the end of 2018.

Jeff Heynen, an analyst at consultant S&P Global Market Intelligence, told CSI: "AT&T anticipate the huge amounts of data they expect to process through IoT and various cloud services and they want to make sure they do that at the edge where it's more efficient rather than backhauling computing function to a central office."

### **Don't fall off**

The prospect of service providers moving more systems to the edge raises various questions related to network technology, logistics, economics and security.

"One of the key challenges is infrastructure," says Lawson-Shanks at EdgeConneX. "The Internet was never designed for a lot of the technologies the edge now demands. Getting the bits or the devices to the edge requires a different type of thinking when it comes to the enclosure, power, protection, and getting high quality fiber networks out from traditional meeting points, or large-scale mega data centers."

Edge computing will reduce the need for high bandwidth and high computational power in the cloud and service providers will have to think hard about what they distribute where and the relative benefits. IT architects may have to consider factors such as latency, geographical location, stability, federation and security when designing a new network system.

Recent moves by MSOs into Distributed Access Architecture and placing more CMTS and CCAP capabilities into optical nodes could provide a roadmap for their future edge



computing deployments.

Heynen at S&P Global comments: "Optical nodes will really become a critical location and central piece to networks going forward. As well as traditional DOCSIS data, they will be supporting small cells, WiFi and Mesh Wi-Fi deployments, so it makes sense to push edge computing out there too."

Moving functionality out of the head end could make it possible to transform and reengineer those locations into data centres able to process incoming data from nodes. Other traffic that can't be efficiently processed in close to the edge could remain in a central location.

But efforts to decentralise networks could also increase complexity and cost. Performance monitoring could become more onerous, having to be carried out at multiple nodes, with the need for appropriate new tools for tracking and correcting issues.

Paul Hughes, Director of Strategy at Netcracker told CSI: "A loss of centralised processes and control

will mean greater complexity when managing service delivery

## “Security could be one of the big trade-offs.”

and performance consistency, new tools will be required for service quality management which will require investment.”

As a result, network players with wider geographical distribution, already be caching data closer to end users, will have an advantage. At the same time, companies that follow a centralised model, with big data centres in few strategic locations, may face bigger investments.

Widespread adoption of the IoT, used in everything from wearable devices, to smart homes and autonomous cars etc, could one day result in edge computers at hundreds of thousands of locations, each one processing and storing vast quantities of personal data. These requirements raise significant data privacy, security and regulatory concerns that will require new investments.

“Security could be one of the big trade-offs,” says Phill Lawson. “You could see information distributed in many different places, in buildings, in a container, or another enclosure, instead of the traditional, bunker-style data centre. This could be addressed by leveraging a big pipe, or private high capacity network such as PacketFabric or Megaport. In the future, these companies may have smaller edge implementations at micro edge data centres.”

### What do edge data centres mean for video?

For TV delivery the experience is further enhanced because edge computing (and storage) allows TV services to bypass most of the network

and avoid the risk of congestion and buffering.

“The main trade off in TV delivery is between a more efficient network with better customer experience (in a more distributed system) vs more efficient sharing of IT infrastructure and higher risk of buffering (in a centralized system). Start with a proven system that is optimised for TV – your core business – and add on other services as you need them – not the other way around,” says Brandon at Edgeware, which uses purpose-built TV servers designed to be deployed deep in the network.

But edge computing has an even broader significance that may entirely transform the way businesses currently operate. The prospect of being able to deliver high quality video content to mobiles using 5G over the edge could have major ramifications for the future of fixed services, potentially displacing coax or fiber entirely. And with larger amounts of data being collected and analysed at the edge, compared to the cloud, perhaps only those players with massive scalability and large-scale processing capabilities will be able to thrive, or indeed survive.

Whatever the future holds, a shift towards the edge seems key for any operator wanting to keep eyeballs on screens. “In the next two or three years, every business should consider a shift in computing capabilities to edge networks and edge data centre facilities,” says Luca Collacciani, Senior Director of Web and Security for EMEA at Akamai. “This should be the main goal of any organisation that wants to maintain a great user experience. Having massive computational capabilities in a few centralised locations will not work anymore as this will likely result in congestion, which means poor experience for customers. It’s vital to place servers at the edge because that is where the bandwidth is. It means customers can avoid

### CORD open source project

The technology is ramping up in conjunction with a convergence in access technologies. Some of that convergence is being driven by the Central Office Re-architected as a Data Center (CORD) open source project. The basic concept behind CORD is to change the equipment at the central office from proprietary gear to commoditized servers, running open source software.

Telcos such as AT&T were the first to jump on board with CORD – hence the words “central office” in the name. But CORD soon formed an off-shoot project – Mobile CORD (M-CORD) – for wireless infrastructure. And even the cable company Comcast, which uses specific access technology for cable video and broadband, has joined CORD.

The cable membership organization CableLabs is also getting in on the convergence action. It recently published a white paper on NFV priorities for 5G. The purpose of the paper is to figure out the key requirements from an NFV and SDN point of view to actualize 5G. But the paper steers clear of talking about fixed access versus mobile access.

Tetsuya Nakamura, a principal systems architect at CableLabs, said, “In 5G we need to consider all the possible access networks. From a cable point of view, it’s a little hard to say mobile. Multi-access makes sense.”

And with multiple access technologies converging at CORD locations, these spots – whether they’re called data centres or central offices or cable headends – are going to be prime candidates for edge computing.

bottlenecks and get a great experience,” he concludes. **csi**

# The DTG's crystal ball for 2018

After years of whispers on what the future could hold, as an industry, we are now full steam ahead with innovative plans for IP, AI and personalisation



**A**rtificial Intelligence This term has taken prime position in recent industry related press, but have we lost sight of what AI really is? In its defined state, AI is "the theory and development of computer systems able to perform tasks normally requiring human intelligence". What we are seeing a lot of is narrow intelligence or weak AI, in which technology with AI is focussed on one narrow task, rather than having the ability to multitask and perform as a machine impersonating human awareness and adaptability.

From the recent technology showcases at CES, it appears that AI has already confidently arrived into our lives and we expect this discreet infiltration to grow with some speed in 2018. In order for AI to seamlessly enhance our lives it is imperative that it improves the user experience and provides practical solutions to the mundane tasks we endure. Most commonly we have seen AI filter into automotive technology and social media platforms and as we progress through 2018 and beyond we should see more and more platforms subtly

incorporating the benefits of AI. We are most excited to see this develop in the areas of television and the connected home; particularly in terms of personalising the television experience where we will see true suggestions matched

to consumer tastes and behaviours and the automatic adjustments to prepare the home environment for optimal viewing experiences (lighting changes, automatic loading of media platforms).

## Voice Assistants

Coupled with the power of AI, voice assistants are set to become the norm in device and technology control, offering the most effortless manipulation of technology - when it works as it should. We expect voice assistants to be incorporated more substantially into our lives in 2018. With major players, Google, Amazon and Apple enhancing their products with voice activated features, we expect to see more of this across the market, even in budget devices (NowTV streaming stick with voice control remote) making this functionality the norm in more homes than ever before.

We hope to see advances in the ability of voice assistants which improve accessibility of products particularly with reference to dexterity, mobility and sight impairment. We consistently work on the accessibility specifications of television with The DTG's U-Book and anticipate a promising implementation of voice assistants to overcome the

shortfalls of traditional functions, such as the ease of visibility and interaction with remote controls (no need to fiddle with minuscule buttons or faded labels), subtitles (a simple voice command to switch subtitles on/off), locating content and recommendations and adjusting settings (eg volume, brightness).

Voice assistants also open a new level of security and parental control. No longer will children be able to spy on the passcode to authorise electronic purchases or give false parental consent to view inappropriate material. We'll see settings to allow only certain voices to have master control of devices and the home with for example lighting, heating and restricted hours of viewing on the television.

## Television

After years of proclamations that television is over, due to the stellar rise of mobile devices, we hope that 2018 will be the year that finally quashes this theory. Despite a broad audience of mobile device users, there is still the need for a larger screen to deliver an optimum viewing experience. With the excitement of the Winter Olympics and FIFA in the Summer, retailers will undoubtedly be offering their best deals to tempt consumers with competitive pricing for the latest high-spec televisions, we confidently expect to see a new-found love of television in 2018. This should also be the year when UHD/4K televisions are more widely welcomed into the average home and, with manufacturers implementing both PQ10 and HLG High Dynamic Range technologies, and broadcasters and content providers delivering more HDR content, viewers will see the benefits of this improved viewing experience. **CSI**



**Peter Sellar** is Associate Director, Programme Delivery, the DTG

# VoD explores new ground

Anna Tobin looks at video-on-demand content strategies in emerging markets and how they compare to more advanced regions

**V**ideo-on-demand (VoD) is rapidly becoming the most popular way of consuming video. Unfortunately for the content providers that have carved out a worldwide presence for themselves by developing hit content and buying up international rights, the global masses do not all have the same viewing tastes. Fortunately for the smaller regional players this gives them a chance not just to survive, but also to thrive, particularly in emerging markets.

What differentiates niche content providers from mainstream giants, such as Netflix, is that they have an in-depth knowledge of their market and buy the rights to content that is linguistically and culturally tailored to it, pinpoints Rich Amos, CTO at Ostmodern.

"The mainstream providers face a bigger challenge in emerging markets. These local niche companies come with local knowledge and can work more efficiently within that market due to language. This allows them to move faster and outplay someone like a Netflix."

"iflix is a good example of this. It offers a similar service to Netflix, but it

takes a different angle in terms of what it does with its content and where it

**"iflix offers a similar service to Netflix, but it takes a different angle in terms of what it does with its content and where it buys the rights from."**

buys the rights from."

Malaysian-based VoD provider iflix offers a mix of Hollywood and Asian content. Operating across Asia, the Middle East and Africa, it has integrated distribution partnerships with about 30 telcos who bundle the iflix service with customers' mobile and data subscriptions. Sky, Liberty Global and Hearst are among its investors, serving as proof of its perceived value.

Netflix knows it needs to partly localise to thrive in new markets. It's employing a strategy of 'localised globalisation', with a mix of about half of its original content coming from the US and the rest from key territories in local languages. It recently announced a Polish original, for example.

iflix for one doesn't seem to be concerned. It could be said that iflix is more worried about competition from pirate services than it is from the likes of Netflix. Like Netflix before it, iflix is said to mine data from piracy uptake

when assessing what content to buy. It then seeks to obtain that content and offer it at superior quality to the pirates at the same or better price.

Good quality niche content will replace piracy, reckons Fabio Murra, SVP of product and marketing at V-Nova. "Niche content is sticky. The audience is focused on it. It beats buying pirated DVD copies in the market."

A new streaming service will be appearing in Africa shortly. Backed by Envivo and Cisco, nVIVO TV is set for launch in the first quarter of 2018, and is aimed at giving subscribers access to more Nollywood (Nigerian-grown) and international video content on mobile phones, tablets and PCs throughout Africa as these devices proliferate across the region.

"The vision of nVIVO TV is to drive the African and African diaspora market toward a new online streaming experience that provides significant domestic content," said Olu Obadina, Chairman and Chief Innovation Officer at Envivo.

## Local regulations

Regulations bar some content from being streamed in some regions. This restricts the orthodox players and boosts the regional players and pirates.

"In the short-term, regulations such as the ones limiting content rights portability across countries in Europe, highlighted by the recent decision made by the European parliament to maintain such rule, set the playing field."

"Other national regulations, such as mandatory contributions to content - film and music - creation funds, also play a role in defining the local offering," highlights Simon Trudelle, senior director product marketing at Nagra.

Children's content is particularly restricted by regional regulations, which increases demand for local production in that genre. "Kids content regulations



change dramatically throughout the world. The ability to have a one size fits all in every region is diminished because of that," says Amos at Ostmodern.

### Micro regions

Fragmentation in the Asia Pacific region is what is boosting opportunities for VoD operators there says Murra at V-Nova. "The first deployment we had in India was with FastFilmz, a company that addresses regional content within a region of India with Tamil and Telugu movies.

"Initially it sounded crazy to us as a business idea because the market is so niche. It turns out, however, that it's potentially 220 million pairs of eyes. There is a large regional film industry there too, so the content is readily available," says Murra.

The issue that FastFilmz had was reaching people with that niche content. It's not just targeted content that's key in emerging markets, it's also about appreciating the differences in viewing habits, points out Dr Fleming Lampi, global product director at Access Europe. "What is unique about Indian consumers is that they are incredibly mobile friendly. India is the second largest smartphone market in the world, which makes it one of the primary devices used to watch content in the region."

Appreciating this meant that V-Nova was able to get FastFilmz's content to its audience wherever they were, says Murra. "With our compression software we enabled them to deliver over 2G and 3G mobile networks. We provided the streaming services that connected the content that they had acquired to the fan base of that content."

Mobile device fragmentation with the dominance of Android OS and cheaper cellphones in emerging markets makes delivery to mobile a challenge though, adds Iddo Shai director of product at Kaltura. "To gain a large market share, the OTT service needs to maintain many apps that perform well across many

**Netflix subscribers as a % of total SVOD subscribers in 2022**

|                     |              |
|---------------------|--------------|
| <b>UK</b>           | <b>52.5%</b> |
| <b>Brazil</b>       | <b>50.6%</b> |
| <b>USA</b>          | <b>36.9%</b> |
| <b>France</b>       | <b>36.4%</b> |
| <b>Poland</b>       | <b>29.2%</b> |
| <b>Saudi Arabia</b> | <b>24%</b>   |
| <b>Malaysia</b>     | <b>14.4%</b> |
| <b>Nigeria</b>      | <b>13.3%</b> |
| <b>Japan</b>        | <b>5.6%</b>  |
| <b>India</b>        | <b>3.3%</b>  |
| <b>Global</b>       | <b>23.9%</b> |

phone brands - especially in slow broadband conditions."

Even where a mobile device is not the primary or only screen in an emerging market, for the younger generation it is often their main point of VoD consumption.

Consequently, youth content will partly drive success claims Curt Marvis, CEO and co-founder QYOU Media.

"This is a generation that's grown-up with YouTube and Vimeo. Global programming is not enough to win over these younger audiences," he says. "Millennials are watching homegrown talent on social media platforms, why should they expect any different from their VoD provider?

"For new VoD market entrants to grow, they need to distribute globally, programme locally. There's a real opportunity to target younger audiences with the type of short-form content they engage with online."

### Studios go direct

Now it's a much simpler and relatively cheap process for the major content owners - namely the studios - to go direct to the consumer.

"The major difference between the OTT and broadcast worlds is that the internet democratises content delivery and access," says Eric

Armstrong, vice president, SaaS Solutions at Harmonic.

"With OTT, the barriers to entry are lower than they have ever been in terms of costs, complexity, time to market and, in some cases, regulations. Many content owners can and do deliver directly to consumers without going through a middleman like a cable provider. That is the definition of OTT.

"Given the nature of OTT, we expect this trend to continue, with major content owners – including movie studios, sports franchises, celebrities and niche players offering more direct-to-consumer options, while also licensing to aggregators."

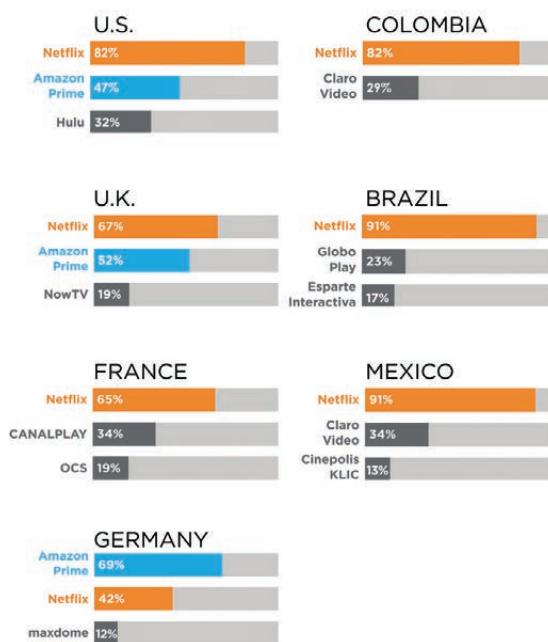
Disney is already experimenting with a direct VoD and PPV proposition. At the moment it seems to be going down the exclusive route hoping that the Disney and Pixar brands and its sports offerings will entice people to sign up. Consequently, it's ended its deal with Netflix.

With OTT becoming ubiquitous and service providers embracing VoD on-boarding, every content owner looking at maximising revenues will soon need a VoD offering packaged as an "app" on various platforms predicts Trudelle at Nagra.

"It's a business must-do strategy. Missing out on that opportunity will be

For now, over-the-top (OTT) services predominantly complement pay-TV, with Netflix and Amazon flexing considerable muscle.

Top streaming services (percentage of self-identified SVoD subs who have this service):



Source: TiVo

a bit like not being an Amazon, eBay or local e-commerce leader affiliate for a small retailer," he says.

### Stacking up

As the market gets crowded with different content owners peddling their wares a battle for eyeballs will result. The question is will the audience be happy to stack up OTT services, pick and mix content from a selection of providers and pay a number of small monthly fees or would they prefer their content bundled up in a single package with a single bill?

If the content is compelling enough and there are no leaving penalties then consumers will purchase a variety of streaming services predicts Armstrong at Harmonic. "Most streaming services are paid for monthly and don't require a long-term contract. The pay-as-you-go business model is popular, especially with younger demographics. It's low cost, low commitment."

OTT stacking is the way the market is going agrees Adam Nightingale, SVP International at Accedo. "We see

numerous examples of consumers subscribing to multiple OTT platforms. Some will churn in and out of, some will be hardy perennials which endure and satisfy year round."

Not everyone will be able to afford to stack up services though says Trudelle at Nagra. "As the cost of stacking for consumers goes up, this will trigger the rise of the smart aggregator that will be able to offer value-driven packages to meet specific consumer needs."

There will also be a blurring of boundaries between OTT VoD content and traditional

pay-TV predicts Lakshmana Pamarthi, head of marketing and business development at ActiveVideo. "We expect an increase in integration of pay-TV and online content in response to subscriber demand for simpler content accessibility," she says.

Personalised content backed by sophisticated recommendation engines will become highly relevant. Some of the niche players are utilising artificial intelligence to provide curated channels - that's a trend that will grow. Easy and intuitive content discovery through next generation UX, voice, and remote will also be refined."

Getting found in a sea of content is vital to survival in any market, but particularly for niche players agrees Trudelle. "While the big media and content brands are becoming highly visible through their platform-based SVoD offerings available on all screens, being the "app store" stars, niche content players have also started finding their way onto long-form platforms like Roku, Apple TV and Amazon Fire TV. Many are also present in operator-

owned app stores or VoD catalogues.

"The key for niche content owners is to provide rich metadata and help aggregators from SVoD pure players to traditional pay-TV operators, index their content and expose it in smart search interfaces and other discovery mechanisms that enable viewers to connect with the content they love."

### Going local

You need quality of service alongside great content to succeed anywhere, emphasises Armstrong at Harmonic. "Viewers expect the same quality or better for OTT services as they do for traditional broadcast. OTT providers must offer pristine video quality, with unlimited viewing capabilities on any device, uninterrupted, with no buffering."

Quality wasn't a problem though for streaming VoD services HBO Netherlands or Canadian shomi, which both shut down recently. Neither company has provided clear reasons for withdrawing these services. It's likely that they felt that the investment wasn't worth the return.

To really succeed in a new market, Nightingale at Accedo points out that the challenges come down to localisation. "The right language, the right ways of taking payment and an adequately local feel to the programmatic line-up."

Emerging markets are also more receptive to advertising-based services too. They'll take the ad breaks over higher subs. It is not easy to make this economically viable though calculates Shai at Kaltura. "Since the cost per 1,000 impressions tend to be lower in emerging markets, only services that can reach one million users or more on a daily basis are sustainable, given the content and technology costs."

It's still very much uncharted territory, but there is a pot of gold waiting for whoever finds the winning formula for attracting and retaining audiences in the markets that are only just being tapped. **cs1**

# Top ten IT security predictions for 2018

Ian Kilpatrick, EVP Cyber Security for Nuvias Group, looks at the rapidly changing security scenario faced by companies in 2018

## 1

### **Security blossoms in the boardroom**

Sadly, security breaches will continue to be a regular occurrence in 2018 and organisations will struggle to deal with them. New security challenges will abound and these will grab attention in the boardroom. Senior management is increasingly focusing on security issues and recognising them as a core business risk, rather than the responsibility of the IT department alone. The coming year will see further commitment from the boardroom to ensure that organisations are protected.

### **2. Ransomware has not gone away**

Too much money is being made from ransomware for it to disappear. According to Cyber Security Ventures, global ransomware damage costs for 2017 will exceed \$5billion, with the average amount paid in ransom among office workers around \$1,400. Companies can help prevent

ransomware by tracking everything coming in and out of the network and running AV solutions with anti-ransomware protection.

### **3. IoT – a security time-bomb**

IoT is a rapidly growing phenomenon which will accelerate in 2018, as both consumers and businesses opt for the convenience and benefits that IoT brings. However, manufacturers are not yet routinely building security into IoT devices and 2018 will see further problems generated through the use of insecure IoT. IoT is a major threat and possibly the biggest threat to businesses in the coming years. Unfortunately, it is not easy, and in some cases impossible, to bolt on security as an afterthought with IoT, and many organisations will find it challenging to deal with the consequences of such breaches. As IoT cascades through organisations' infrastructures, it is likely to become the ultimate Trojan horse.

### **4. More from the Shadow Brokers**

The Shadow Brokers, a hacker group which stole hacking tools from the American National Security Agency, created havoc in 2017 with the WannaCry ransomware episode. There will be further episodes from them in 2018, so patch management, security and regular backups will be more crucial. A major target of these hackers is the data that organisations hold, including PII (Personally Identifiable Information) and corporate data, so protecting the data 'crown jewels' inside the network will become more crucial.

### **5. GDPR – have most businesses missed the point?**

Many organisations are missing the main point about GDPR. It is about identifying, protecting and managing PII - any information that could potentially identify a specific individual. This will become more important and there will be considerable focus on identifying, securing and, where required, deleting PII held on networks.

### **6. GDPR Blackmail – the new ransomware?**

GDPR will give a great opportunity to criminals, hackers, disgruntled staff and anyone who might want to do an organisation harm. They simply have to ask you to identify what data you hold on them, ask for it to be erased, and ask for proof that it has been done. If you can't comply, they can threaten to go public – exposing you to the risk of huge fines – unless you pay money.

### **7. DDoS on the rise**

It is now possible for anyone to 'rent' a DDoS attack on the internet. This is just one of the reasons DDoS threats will continue to escalate in 2018, alongside the cost of dealing with them. The dangers of DDoS for smaller companies are that it will leave them unable to do business. For larger organisations, DDoS attacks can overwhelm systems. Remember that DDoS is significantly under-reported, as no-one wants to admit they have been under attack.

### **8. Cloud insecurity – it's up to you**

Problems with cloud insecurity will continue to grow in 2018 as users put more and more data on the cloud, without properly working out how to secure it. It is not the cloud providers' responsibility to secure the information. With the introduction of GDPR in 2018, it will be even more important to ensure that PII stored in the cloud is properly protected. Failure to do so could bring serious financial consequences. **cs1**



# Get Ready for the Next Generation of WAN: SD-WAN

**SD-WAN is here and is poised to alter the enterprise WAN landscape.**

**Mike Wood, VP VeloCloud, explains**

**S**oftware-Defined Wide Area Networks (SD-WAN) are the basis for a new generation of WANs for enterprises and service providers. Just as Frame Relay and ATM migrated to MPLS for business connectivity, the combination of SD-WAN, migration to the cloud, and commodity Internet broadband are offering a compelling, affordable and flexible option to augment the WAN. The move to SD-WAN becomes imperative as demand increases for business critical, bandwidth hungry real time applications in branch offices and field locations.

## What's a WAN and how does it work: The traditional WAN

Before diving into the new world of SD-WAN, let's review traditional wide area networks. A WAN traditionally connects a company's business locations together, creating what's essentially a single large network that might span multiple locations within a city, locations in many cities, or even locations across national boundaries or around the world. Those businesses might have one or more data centers, and multiple offices that have remote workers. The goal is to provide seamless connectivity between remote locations and the applications they reply upon, no matter where those applications are hosted.

Workers inside a business location are connected via a local area network

(LAN), which is a private, high-speed network, installed, owned and maintained by the business. The LAN can be wired and wireless using technologies like Ethernet and WiFi. Likewise, servers within a data center are also tied together with high-speed LANs.

The WAN ties those sites together. By contrast with the high-speed, private LAN owned by the business, WANs are services traditionally provisioned by telecommunications companies. WANs are much slower than LANs, and incur monthly charges based on bandwidth, guaranteed reliability, and the distance between the sites. WANs can take weeks or months to set up, and just as long to make service changes, such as to adding bandwidth to handle new demands.

There are many telecommunications technologies used to implement traditional WANs. Older technologies include leased lines, Frame Relay, ATM (Asynchronous Transfer Mode). One of the most popular WAN technologies today is MPLS (Multi-Protocol Label Switching). While MPLS-based WANs run across one or more carriers' networks using complex protocols, they can be thought of as highly reliable, very secure, point-to-point links between a business' sites. The downside of MPLS-based WANs is that they are expensive, slow to provision, and difficult to change to adapt to varying requirements.

Why not use the Internet for connecting business locations? The Internet is ubiquitous, inexpensive and flexible. However, the Internet is

famously unreliable, both in terms of uptime and in the ability to deliver consistent throughput. It's also insecure, and without additional security, cannot be trusted for intra-business traffic, such as accessing key business applications, servers or files.

The challenge is that businesses are increasingly frustrated with traditional WANs. IT professionals and corporate executives like that WANs are reliable, predictable and secure. On the other hand, they don't like the monthly expense, the slow provisioning time, and the lack of flexibility. They also don't like that WANs become more complex when the business locations are in different countries. Finally, with the emergence of cloud computing the traditional WAN falls short architecturally to the needs of the new paradigm.

## Enter SD-WAN: The Best of Both Worlds

Software-Defined WAN leverages and virtualises multiple types of connections between business locations, including data centers and remote offices, as well as connections between data centers, remote offices, and cloud resources. SD-WAN leverages broadband Internet while providing the ability to incorporate traditional dedicated WAN technologies like MPLS. SD-WAN is transport agnostic and overlays controls that deliver quality of experience and ensure reliability, predictability, security, manageability, and reduced cost.

For example, a company may have several data centers, a few large offices with hundreds of employees, and a few hundred small field offices. It may also use cloud-based services for applications, servers, and storage, with a mandate to eventually migrate the bulk of its data centers to the cloud.

From the users' perspective, SD-WAN is a single wide area network that offers



trustworthy security, plenty of bandwidth, service reliability, quality of service (QoS) that ensures a good user experience when making calls using Voice over IP (VoIP) or videoconferencing, and seamless access to both data center and cloud applications.

From the IT department's perspective, SD-WAN offers a single interface to manage the wide area network, with the ability to rapidly adjust the services to accommodate new requirements, or to provision new services.

However, under the surface SD-WAN takes advantage of multiple types of network connections, including traditional WAN technologies, the public Internet, and even cellular data connections.

Demand is escalating for business critical, real time applications such as voice, video and virtual desktop applications. Adding more private circuits for these bandwidth hungry applications is expensive and does not improve cloud application connectivity. A cost effective solution is to leverage broadband public Internet to augment the MPLS links by using SD-WAN.

Employees in main offices and branches need to access Software-as-a-Service applications. SD-WAN understands the location of those applications, and will directs user sessions directly to the cloud efficiently, using the high quality link for the highest priority applications. This

represents a significant improvement over the traditional WAN architecture model, which routes remote employee traffic over the MPLS network back to a data center and then redirects cloud application traffic from there to the Internet. This adds delay and consumes unnecessary WAN bandwidth.

In short: SD-WAN leverages multiple WAN technologies and other connections, lowering monthly costs, simplifying operations, adding agility, providing full security, and offering end users an exceptional experience. It's a perfect technology for connecting branch offices and even short-term "pop-up" business locations that need to be brought up instantly such as construction sites and some retail locations.

For a deeper dive into the technology behind the SD-WAN, see "SD-WAN for Dummies," by Dan Pitt and Lee Doyle. The e-book is available for free download.

### **Implementing the SD-WAN**

If providing WAN virtualisation, abstraction and coordination is what SD-WAN does... what is the SD-WAN product itself? Generally speaking, SD-WAN is a software control layer that contains a few parts. There is a management tool, implemented in a dashboard, that provides easy administration by IT professionals, with minimal effort by staff in the field location. There is a control plane, that actively and intelligently

manages and routes network traffic over all available communications technologies in accordance with business priorities. And there is a business policy framework, which sets requirements and baselines for security, quality of service, cost controls, user experience and application priorities.

SD-WAN controls can be located within the business' data center, but optimally it will be run via the cloud, where it is equally accessible to all business locations, and where it can be managed as Software-as-a-Service - thereby reducing the workload on corporate IT.

Enterprises have a variety of options when it comes to choosing SD-WAN. They can contract directly with a provider of the SD-WAN software solution, and implement it using internal staff. For some organizations, that will be the best choice. For others, there are new SD-WAN offerings from major telecommunications service providers, who are adding SD-WAN to their portfolio of WAN offerings.

For example, AT&T announced a partnership with VeloCloud, a leading provider of SD-WAN infrastructure delivered as either a cloud-based solution or an on-premises software. The AT&T SD-WAN service will let businesses intelligently prioritise and route data across their networks based on the performance requirements of the applications. The offering, which is powered by SD-WAN vendor VeloCloud, will also let businesses better manage their bandwidth, AT&T said. AT&T's SD-WAN offering will come in two flavors - a network-based offering and a premises-based solution.

For today's agile businesses, branch office connectivity is not a luxury; it's business-critical. SD-WAN technology ushers enterprise WAN to the cloud era enabling quality of experience, reduction in Capex and Opex and greatly simplifying branch WAN infrastructure. Get ready for the next-generation WAN: the SD-WAN. **csim**

**W**as it the White Walkers or the Demodogs that choked the mobile network in 2017?

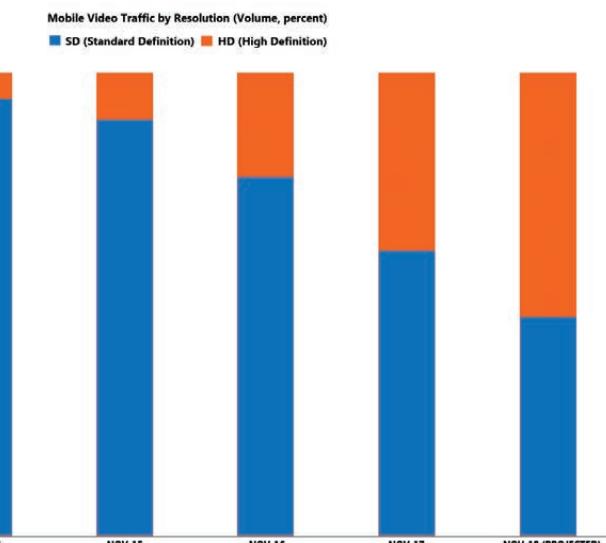
These two popular antagonists from Game of Thrones (GoT) and Stranger Things 2 have gripped millions of viewers. According to Nielsen, each episode of GoT series 7 was watched on average by just over 30 million in the US alone and data from Parrot

Analytics found that Stranger Things 2 registered over 70m Video on-Demand requests. TV series have proliferated like the White Walkers on GoT. Even the intense battle to win subscribers and deliver content is reminiscent of the struggle to win the Iron Throne.

In 2017 just over 500 TV series were produced to win over audiences.

Netflix, HBO and Amazon have been the juggernauts for streaming content. Now, the balance of power could be shifting. Disney's recent acquisition of Fox, its move to remove content from Netflix - while launching its own streaming service in 2019 – is heating up the streaming wars.

Caught in the middle of this power struggle are the mobile operators. They have the unenviable task of delivering



# Winter is here for mobile optimisation

Games of Thrones might feature extravagant action scenes, but the real epic battle is taking place on the mobile network, writes Matt Halligan, CTO and Head of Engineering of Openwave Mobility

those hugely popular shows via packets of mobile data to subscribers. As smartphone screens have increased in size, resolution and quality, subscribers have turned to them in droves to watch "TV" shows on their mobiles. It is estimated that well over 820 million people across the world watch YouTube and Netflix alone on mobile devices.

PCs and smartphones, coupled with devices such as the Amazon Fire Stick and Google Chromecast are transforming the humble TV. Just in the past three months of 2017, half a million people in the US cut their cable and satellite subscription. This is a worrying trend that is bound to replicate globally.

Facing a race against time to keep pace with changing viewing habits,

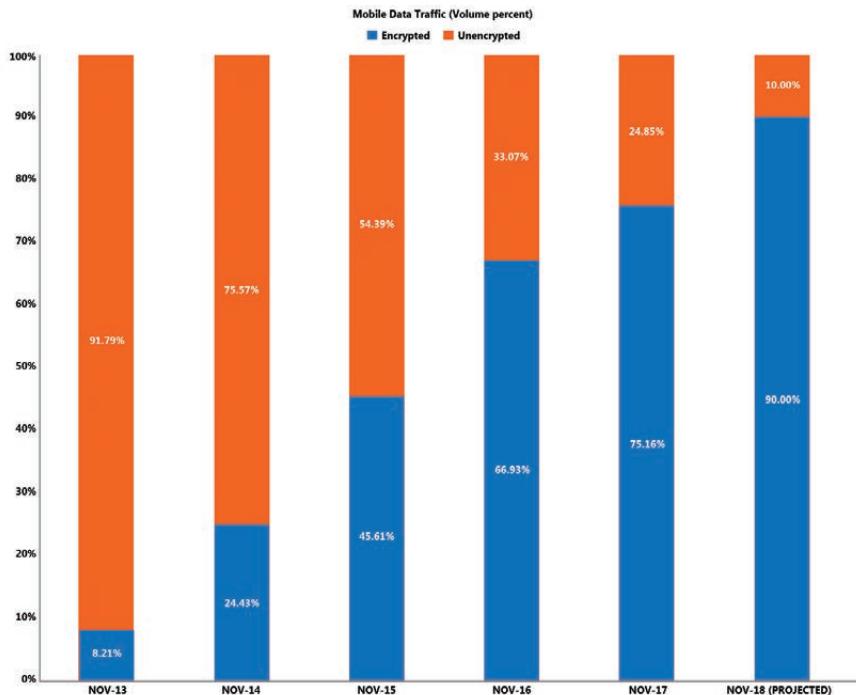
carriers have invested billions to converge services and have a second screen strategy for mobiles. You would think operators would be on safe ground with this approach. Not so. OTT providers such as Google and Facebook have launched a land grab for mobile and the operators are losing ground.

In three years, services such as Skype and WhatsApp finished off voice revenues for operators. In two and a half years, the likes of Viber and Facebook Messenger destroyed messaging revenues. Mobile data is next on the OTT menu. Why? Research has found that network providers face a two-pronged OTT attack in the shape of HD and encryption. And this is impacting Quality of Experience (QoE) and operators are losing control of their networks.

## No one expected the HD invasion

The Mobile Video Index (MVI) published the analysis gathered from over 30 live deployments globally looking at the impact of mobile video and QoE. Unsurprisingly, mobile video consumption is growing at a phenomenal rate. In 2017, mobile video represented 58% of traffic by volume worldwide.

What caught mobile operators off guard was the level of HD video content. HD was only 5.7% four years ago and in 2017 reached 38% - far beyond what mobile operators had



predicted. This is significant because HD requires three to four times more bandwidth than standard definition videos. According to MVI data, HD will reach at least 50% of video traffic by the end of 2018. In other words, HD is consuming more network resources and choking the Radio Access Network.

### No one saw QUIC coming

MVI data also indicates that 75% of all mobile traffic is now encrypted. UDP-based (User Datagram Protocol) encryption has grown faster than operators had predicted and Google's QUIC protocol, which has come out of nowhere and grown at an astonishing rate and will be 32% of global internet traffic by the end of 2018. What's more, Facebook has introduced its own encryption - Zero Protocol (0-RTT). It is still at experimental stage but expect this to soar over a short space of time.

### RIP to (traditional) mobile optimisation

Why is encryption significant? Encryption is darkening the network and preventing operators from gaining visibility. As such, they are unable to manage subscriber QoE with

conventional mobile optimisation and cannot manage the data stream. So, when a subscriber is watching a video on their handset and it buffers – operators have no way of addressing that problem with traditional tools such as Deep Packet Inspection (DPI). Worst of all, poor QoE is a deal breaker for subscribers.

As subscribers get used to watching HD quality shows on their HD-ready TV, they expect the same QoE on their device. Consumer research in the US, Europe and Middle East found that people will only tolerate around 6 seconds of video buffering before turning it off in frustration – and the majority blamed the mobile operator for poor QoE. So, the challenge then for operators is - how can they manage subscriber QoE when they can't see in the dark?

Given how the OTT threat has evolved within a short space of time – a number of operators have come to realise that standard optimisation is obsolete as they can no longer just “enhance” their network and hope to retain control of subscriber QoE. Existing DPI solutions are a dead piece of investment. The protocols and

signatures DPI is looking out for now – may not even exist within a few months.

### Seeing through the fog of the encryption war

Operators need a robust strategy to manage and monetise their mobile data. Just as Machine Learning (ML) is disrupting almost every facet of life, mobile operators too should utilise ML in the fightback. New mobile data management technology can identify and differentiate traffic streams and intelligently adjust encrypted Adaptive Bitrate for videos and reduce the impact on the RAN – and still deliver outstanding QoE to subscribers.

Network providers need night vision goggles in the form of technology that gives them visibility into their darkened networks. This would help operators to recognise and fingerprint the data that is flowing through their networks from services such as Facebook, Netflix and YouTube – so they have the capability to monetise popular services and secure new revenue streams.

### An unconventional revolution

Between the 1940s–60s, broadcasters pioneered live television to herald a golden age of TV. The new golden age of TV has been supercharged by the likes of Netflix, Amazon, HBO and YouTube with hundreds billions of Dollars in their war chest. Ironically, this golden age of “TV” is actually taking place online rather than on a conventional television. Disney, meanwhile, plans to produce Star Wars TV shows and go direct-to-consumer.

Given the unconventional TV revolution sweeping the globe, network operators can no longer rely on conventional optimisation to stave off the OTT onslaught. OTTs will continue to launch salvos in 2018 and beyond in the form of increased encryption and petabytes of new HD content.

That's just a taste of things to come. For network operators, the tag line from GoT season 7 might ring true: Winter is here. 



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- IP Playout
- Best use of AI in video

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4. Best monitoring or network management solution
5. Best content protection technology
6. Best content-on-demand solution
7. Best interactive TV technology or application
8. Best mobile TV technology or service
9. Best internet TV technology or service
10. Best ultra HD TV technology or project
11. Best TV everywhere/multi-screen video
12. Best social TV technology, service or application
13. Best data & analytics innovation
14. Best cloud/virtualisation innovation
15. Best IoT or smart home service or solution
16. Best virtual reality innovation
17. Best 5G project or innovation
18. Best TV user experience (UX) - NEW CATEGORY
19. IP playout - NEW CATEGORY
20. Best use of AI in video - NEW CATEGORY

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## Events diary 2018

| Date                    | Name                     | Location       | Website  |
|-------------------------|--------------------------|----------------|--|
| 14-16 January           | CabSat                   | Dubai          | <a href="http://www.cabsat.com">www.cabsat.com</a>   |
| 13-15 February          | FTTH Council Europe      | Valencia       | <a href="http://www.ftthconference.eu">www.ftthconference.eu</a>   |
| 30-January - 1 February | CSTB Telecom & Media     | Moscow         | <a href="https://en.cstb.ru">https://en.cstb.ru</a>  |
| 26 February - 1 March   | Mobile World Congress    | Barcelona      | <a href="http://www.mobileworldcongress.com">www.mobileworldcongress.com</a>                             |
| 27 February - 1 March   | BVE                      | London         | <a href="http://bvexpo.com">bvexpo.com</a>   |
| 6-7 March               | Cable Congress           | Dublin         | <a href="http://cablecongress.com">cablecongress.com</a>   |
| 12-15 March             | Satellite 2018           | Washington DC  | <a href="http://2018.satshow.com">http://2018.satshow.com</a>  |
| 12-14 March             | DVB World                | Warsaw         | <a href="http://dvbworld.org">dvbworld.org</a>   |
| 20-21 March             | Connected TV Summit      | London         | <a href="http://connectedtvsummit.com">connectedtvsummit.com</a>   |
| 27-28 March             | Broadthinking            | Geneva         | <a href="http://tech.ebu.ch/events/2018/broadthinking2018">tech.ebu.ch/events/2018/broadthinking2018</a> |
| 9-12 April              | MIPTV                    | Cannes         | <a href="http://www.mipty.com">www.mipty.com</a>   |
| 07-12 April             | NAB                      | Las Vegas      | <a href="http://nabshow.com">nabshow.com</a>   |
| 26-29 April             | ASBU Radio & TV Festival | Tunis          | <a href="http://www.asbu.net/home.php?lang=ar">www.asbu.net/home.php?lang=ar</a>                         |
| 9-10 May                | TV Connect               | London Olympia | <a href="https://tmt.knect365.com/tv-connect">https://tmt.knect365.com/tv-connect</a>                    |
| 10 May                  | DTG Summit               | London         | <a href="http://dtg.org.uk/dtg/summit.html">dtg.org.uk/dtg/summit.html</a>                               |
| 26-28 June              | Broadcast Asia           | Singapore      | <a href="http://broadcast-asia.com">broadcast-asia.com</a>   |
| 12-14 June              | ANGA Com                 | Cologne        | <a href="http://angacom.de/en">angacom.de/en</a>   |
| 31 August -5 September  | IFA                      | Berlin         | <a href="https://b2b.ifa-berlin.com">https://b2b.ifa-berlin.com</a>                                      |
| 13-18 September         | IBC                      | Amsterdam      | <a href="http://ibc.org">ibc.org</a>   |
| 4-6 October             | IFTV                     | Istanbul       | <a href="http://iftv.org/US/index">http://iftv.org/US/index</a>  |
| 10-11 October           | AI World Summit          | Amsterdam      | <a href="http://worldsummit.ai">worldsummit.ai</a>   |
| 15-18 October           | MipCom                   | Cannes         | <a href="http://mipcom.com">mipcom.com</a>   |
| 22-25 October           | SCTE/ISBE Cable-Tec Expo | Atlanta        | <a href="http://expo.scte.org">expo.scte.org</a>   |
| November 2018           | OTT TV World Summit      | London         | <a href="http://ottworldsummit.com">ottworldsummit.com</a>   |
| November 2018           | CDN World Summit         | London         | <a href="http://cdnworldsummit.com">cdnworldsummit.com</a>   |
| November 2018           | Connections Europe       | Amsterdam      | <a href="http://parksassociates.com/events">parksassociates.com/events</a>                               |
| December 2018           | Future TV Advertising    | London         | <a href="http://futuretvads.com">futuretvads.com</a>   |

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