In order to provide Quality of Service and Quality of Experience in an increasingly competitive pay-TV landscape, broadcasters and service providers need to ensure the reliability and consistency of video and audio delivery across a range of platforms and devices. *Euromedia* spoke to a range of sector players to find out how they are responding to market dynamics and enabling their broadcaster and service provider clients to maintain market share and protect revenue.

Test and Monitor Segment Survey 2012

Euromedia: **What are the most important recent developments impacting on T&M?**

Agama: True shift towards more individual TV services has become the reality in Europe this year. The 'traditional' operators are now widely offering and delivering OTT and multiscreen services, and new kinds of service providers have entered the market. It's a dramatically more competitive landscape where the consumers have more and more options to choose from.

This will allow some operators to rapidly grow their subscriber base, but it can be a case of 'easy come, easy go'. Should the operator make any serious mistakes, it could equally rapid lose large parts of its subscriber base. The increased dynamics in the market further emphasise the rising importance for keeping existing customers, i.e. minimise churn, as well as keeping customer acquisition costs down.

As operators start managing services across several platforms with diversified consumer end users, we see that their need for transparency and a rich understanding of the service delivery increase is needed to assure the service quality. It is now established that some kind of service quality monitoring at the actual point of service consumption is vital to ensure quality of service.

Bridge Technologies: OTT remains the big challenge, and the big opportunity. New technology, new business models, new companies, new partners - all these can affect quality and stability. Technical issues arising from these changes can result in loss of revenue, loss of confidence, damage to the brand, frustration and eventual loss of customers. The way to avoid this is to design OTT monitoring into the network from the start.

Another trend, particularly in cable, is that the core IP network is being used for more and more services: forward video distribution, OTT distribution, voice traffic, broadband internet traffic, and VoD traffic. So this impacts monitoring/analysis in that the customer wants to look at an all-in-one monitoring solution and not have separate systems for each service.

Digital TV Labs: IP (OTT) enablement in traditional broadcast CE devices is driving convergence in service provisions. A key example is catch-up TV: once a PC-only service, it's now being offered via HbbTV-enabled devices, and apps found in smartphones and tablets are making their way to smart TV's. To provide such services requires numerous additional software and hardware features for actual delivery, from Ethernet/Wi-Fi interfaces to

browser and multiple DRM capabilities - in addition to existing CAS support - and broadcast signalling integration. This added complexity has a knock-on impact on testing such devices to ensure conformance and interoperability.

Effigis: First, the ongoing transition from a mix of analogue/digital services to all-digital services in broadband cable networks. Second, the introduction of Long Term Evolution (LTE) broadcast cellular services, in which the RF operating frequencies overlap those of broadband cabled coaxial networks. This RF spectrum overlap generates interference impairments in both networks.

Farncombe: The automation of testing continues to be the key area of interest judging by the conversations we have with our clients. This can be either using off-the-shelf products or solutions that have been developed in-house.

Harris: This year has seen a number of developments in broadcast technology from the transmission and consumption point of view. From a technology point of view, we are seeing the need for enhanced IP compression technologies due to the rising prevalence of additional delivered services such as OTT and multi-programme transmission over an increasing limited bandwidth. From a technology point of view, the evolving international standards on, for example, loudness monitoring and DVB-T2 presents an increasing set of standards for us to work seamlessly with.

JDSU: Competition in the broadband services market continues to grow,

creating significant challenges for Communication Service Providers (CSPs) deploying new access networks based on VDSL2, FTTH, WiMAX, or LTE. These challenges include fixed and mobile multi-play service convergence, creative multi-play service offerings, and pricing pressures. At the same time, CSPs must support and maintain both their legacy and next-generation access and home networks using various technologies like WiFi, PLT, HPNA, or MoCA. In addition to these technological demands, broadband CSPs are being squeezed to their limits to find new ways to reduce their operating expenses (OpEx) as competition drives their revenues down.

Several challenges make it hard for CSPs to significantly move the needle: Lack of visibility in the home network, network elements that are blind to the services they are transporting, too many and too long customer care calls (especially with IPTV), and too many trial-and-error field dispatches to find and fix problems with too many unnecessary CPE device replacements.

Mariner: Two inter-related service trends are combining to challenge the adequacy and effectiveness of established Test and Monitor solutions. On the one hand the IP service environment is becoming increasingly technically complex, and on the other video itself presents new challenges in order to meet consumer expectations. Traditional OSS tools and techniques, which are perfectly adequate for managing traditional broadband data services, are not so good of highlighting subtle video-affecting issues. Network disturbances which may be insignificant from a traditional data standpoint can be catastrophic for the increasingly important consumer video experience.

Pixelmetrix: With MPEG-based encoding and its packetised transport now stable after over ten years of deployment, the 'traditional' infrastructure has become quite mature and stable. What's changing is new RF technologies being used to deliver the existing services (e.g. DVB-T2 and DVB-S2) as well as the new problems surrounding Over-the-Top TV services.

While DVB-T2 and DVB-S2 are not much different than their respective predecessors, the challenges surrounding OTT are wide and far reaching – from the encoding and transmission technologies, to the topology of the network (and the companies operating the various pieces), to the business model itself.

Almost everyone has an OTT project of some sort – but in our opinion, a clear business model is yet to emerge.

Rohde & Schwarz: The ongoing implementation of an increasing number of DVB-T2 networks is still of relevance to T&M equipment, e.g. monitoring solutions. The maturity of file-based workflows presents specific needs for file-based video material. The variety of formats, codecs and wrappers gives rise to an urgent need for appropriate quality assurance solutions to ensure proper video quality. And TV Everywhere with a variety of streaming formats and OTT mass streaming applications will require appropriate T&M solutions to provide adequate QoS and QoE.

S3 Group: We have seen viewers being given access to an increasing array of content, over a wider number of access networks, onto a rising number of devices. Two major trends are to the fore recently: multiscreen delivery and rising levels of on-demand (both VoD and OTT) content consumption. We believe that in both cases, 'traditional' digital TV service operators will continue to remain the dominant players for the foreseeable future while we see a slow but consistent rise in competition from pure-play OTT service provider.

By our reckoning however, the new multi-screen TV world is driving at least a 60-fold increase in system engineering complexity compared to the networks of a decade ago. Developing, testing and monitoring these networks successfully, all the way from one end to the other through this complexity, on-time and with high quality is increasingly challenging.

At the same time, this year in particular, we have seen huge pressure to control operational costs and one area in particular we have seen which is to cut out unnecessary costs in the support and maintenance of customers.

Skyline Communications: In ever more competitive markets, with ever faster evolving technologies, and ever more demanding customers, there's simply no room for compromises for broadcasters and service providers when it comes to managing service quality and service availability. And the new generation of end-to-end multi-vendor network management software platforms that have emerged over the last couple of years play a key role in managing that service quality and availability.

The consolidation of all information in a single platform enables more intelligent correlation, across systems from different vendors, and faster root cause analysis resulting in an increased quality and availability of services. Furthermore, there's an increasing and ever faster evolving offering of a wide variety of test and monitoring products from different vendors, catering for many different needs, at different pricing levels. The deployment of the new generation of multi-vendor network management software platforms, enables operators to tap into those products more efficiently and quicker than ever before.

Operators can pick and choose different products, depending on their specific needs, across different delivery platforms, and consolidate all the information from those disparate solutions from different vendors in one single platform. That end-to-end multi-vendor network management platform then provides a clear overview of the status and quality of all services, across the entire infrastructure, provides intelligent service-oriented analysis, service level agreement (SLA) tracking, consolidated fault management and reporting, and much more. And new emerging test and monitoring solutions can now easily be deployed alongside existing solutions, in a fully integrated fashion, enabling operators to maximise the leverage in their test and monitoring products.

Witbe: The Test and Monitoring industry has gone through major changes due to the massive migration of all services to IP technologies. Internet has changed our live but the Test and Monitoring industry was one of the 'old' industries that took time to fully realise the problems caused by this migration and the new potential it had to offer.

One of the first major changes is that the sum of the quality no longer equals the quality of the sum. The bottom up classical approach, from devices to services to 'guess' user satisfaction doesn't work anymore. Too much noise, too many false alarms. There is a strong decorellation between classical QoS (Quality of Services from equipment, networks, platforms…) and QoE (Quality of Experience).

The other issue is the fragmentation of devices used to access content and the ability of those devices to improve or degrade quality (as with adaptive bit rate where devices decide what is good or not and how to enhance quality). In an IP world, quality must be measured END TO END, up to any device. However, devices are generally bought and owned by users (BYOD), which makes it very difficult to access information from the device. Applications run in a sandbox, where it's really difficult to have relevant information. We need to change the classical QoS 'pooling' approach with next gen monitoring systems like those Witbe develops.

Euromedia: **How is the T&M segment**

responding to these new challenges?

Agama: We identified these tendencies quite early on, and having an end user experience focused approach is actually central in the philosophy upon which Agama is built. Our approach and solution model for video service quality assurance (QA) have proven to be a very good fit in this market – especially when each individual customer gets increasingly important.

The market is starting to consolidate around that the two delivery chain extremities – the head-end and the consumer end – these are crucial to have under quality control. The head-end, where services are created, modified and bundled, continue to play a central role in service QA, as problems arising here have the potential to hit all viewers. But as a result of more and more individual and mobile TV services, and given the diverse levels of 'black box networks' between the service provider and the consumer, the end of the delivery chain grows increasingly important to truly understand how the service quality is perceived by each individual viewer and how the services are handled.

Bridge: We have been developing OTT monitoring solutions for the last two years and it is a big focus for our continuing research and development effort. Comprehensive OTT capability is available in all of our probes and the OTT monitoring and analysis is fully integrated with any other monitoring the system is doing (for example, cable).

Our VB330 10G solution is aimed directly at the demand for 'one-box-for-all-monitoring-needs', and is popular among the cable operators and others. The VB330 can do IPTV, OTT, general Ethernet traffic analysis, VoD, and voice now, with more to come.

DTV Labs: Until recently, the only way to test a CE product's OTT implementation was within the real system connecting it to live content and DRM servers. Now work has been taking place within organisations such as HbbTV, OIPF - and for real deployments such as the French TNT2.0 hybrid DTT/OTT system - to provide off-line test solutions that not only simulate the real environment, but provide rigorous additional test coverage to ensure interoperability.

Effigis: Cable leakage monitoring equipment manufacturers are developing their digital solution, which will operate in all-digital networks. Historically, broadband cable operators were primarily concerned with cable leakage generated by analogue signals in the aeronautical band, causing potential interference in aircraft/airport tower communications. Even though this still is an important responsibility for them, broadband cable operators are increasingly concerned with ingress/egress interference affecting their services in the return band, and in the upper band overlapping the LTE band.

Since the lowest and highest frequencies

used in a broadband cable plant have different RF propagation characteristics when leaking from the network, the digital leakage monitoring solution should cover both the aeronautical and the LTE bands to accelerate the location and repair process.

Effigis manufactures the CPAT leakage/ingress monitoring system. Its current solution can detect/locate cable leakage in the downstream portion of the plant, as well as ingress impairments affecting the upstream path, to within a few meters.

Farncombe: Automation can be the key to both improving quality and reducing test cost but it requires investment. Test automation runs lots of tests simultaneously producing a huge amount data. It creates a new analysis issue – how are the results to be analysed and what does the analysis show?

Harris: We are constantly reviewing and updating the capabilities of our products; for example, our loudness monitoring for baseband and compressed domain products. This is done through a combination of analysing the trends of the market internationally and responding to direct feedback for our customers. In addition, Harris also introduced a new series of compressed monitoring products a few years ago offering analysis of IP, RF and ASI transport stream which is very well suited to the emerging requirements of DVB-T2 and OTT services.

JDSU: JDSU is a globally recognised leader in the communications test and measurement market. JDSU is committed to research and development to offer game changing, breakthrough solutions in this domain.

Mariner: Service providers are becoming more video-aware, recognising the double-whammy challenge presented by increasing service domain complexity and video-specific phenomena. In response, vendors such as Mariner are developing and offering products which enhance an operator's existing OSS capabilities. The new class of video-specific capabilities do not replace established tools and processes, but extend the operator's armoury by better enabling them to rapidly identify, characterise and remedy video-related issues, in any IP video delivery environment.

Pixelmetrix: Traditional customers are asking for traditional solutions to OTT monitoring and many vendors are launching products that attempt to passively monitor OTT traffic. However, OTT turns television on its head because, unlike the 'push' model of TV to date, OTT clients 'pull' the content from web servers. It is the client that is completely in control. (If there is nobody watching TV, the bandwidth of an OTT network is zero!).

R&S: By developing new and even more workflow-oriented instruments and solutions.

S3: We believe the best way to tackle these new challenges, driving increased quality into the platform, ensuring fast time-to-market despite the new complexity, and reducing costs throughout the supply chain, is to take an integrated view across the full Digital TV platform development lifecycle from requirements right through to reuse and everything in between.

Solutions are now coming to market which allow testing across a wider variety of consumer devices in a consistent way. Where previously the majority of testing of end-to-end service delivery was performed by exercising the interface on only STBs now we are also seeing demand for testing on tablets, connected TVs, gaming stations and PCs. Crucially it is the interaction between these devices in multiscreen viewing homes that is of particular concern and a focus for all players in the test and monitoring space. We see the demand for automation continuing to rise as the industry tries to accelerate its time to market with new features and services across

more devices but without compromising quality.

Skyline: The T&M segment has responded to these challenges with a wide variety of solutions, with different qualities, for different fields of application, and available at different prices.
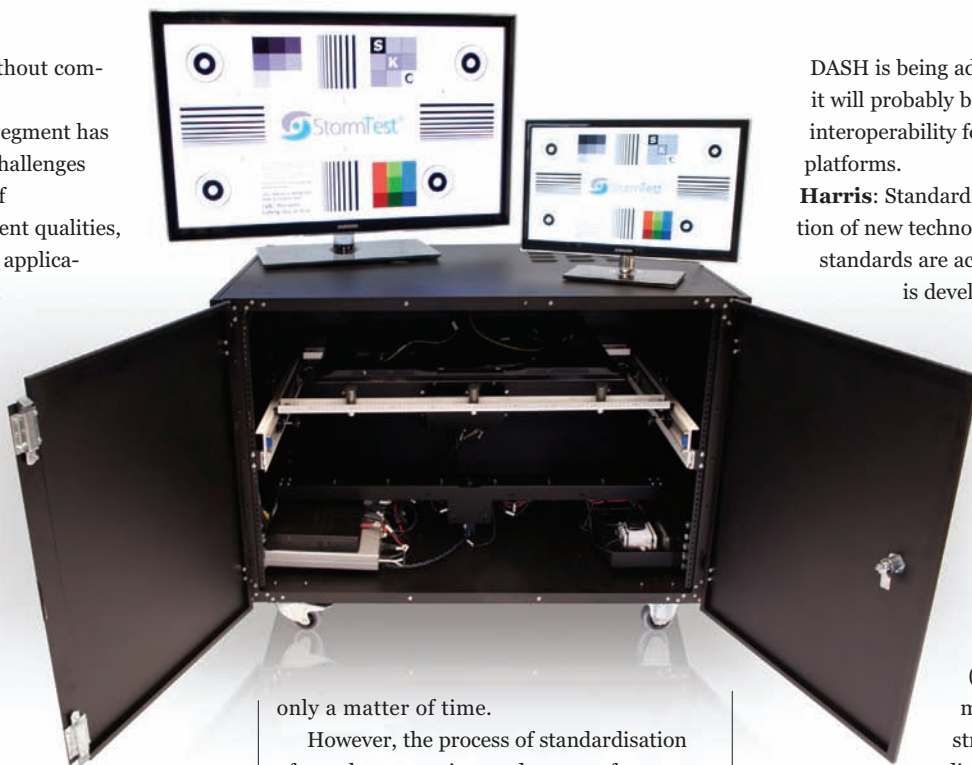
One of the key strategic technologies that has emerged over the last couple of years is powerful end-to-end multi-vendor network management software platforms. One standard off-the-shelf software platform, that enables operators to collect, aggregate and correlate data from the wide variety of products and solutions that they deployed. This includes both data collection on operational devices, as well as quality test and monitoring solutions, as well as data sourced in large volumes from the CPE ecosystem. All of this data combined in a single platform unleashes an unprecedented perspective on the operations, and forms the basis of the future of test and monitoring.

Witbe: Generally not very well! People try to 'guess' the quality of the overall service based on what happens on the streams. The problem is simple: The streams can be good and the user experience bad. The opposite is also true. The stream could be bad, but with FEC (Forward error correction) and retransmission technology, the user experience could be good. This is true for Video services, but the same applies to voice, data and now mobile services. Monitoring equipment individually is needed from an operations perspective, but people have a hard time understanding we've moved to a world where the most important is to control the user experience.

Witbe has been working on this new paradigm for the last 12 years and is now able to deliver relevant and pragmatic solutions to correlate some QoS information and QoE / user experience.

Euromedia: **A number of players are trialling MPEG-DASH. Is this likely to become standard, and will it help address interoperability issues?**

Agama: We definitely see a unifying intent to standardise media players and indications that the market is starting to consolidate around MPEG-DASH. Most seem to agree that it will become standard, that it's only a matter of time.

However, the process of standardisation often takes some time and we are of course following the ongoing initiatives closely, ready to adapt to standards and new innovations where our customers need support from our solution.

Bridge: Possibly it's too little, too late. Apple HLS, Microsoft Smoothstream and Adobe HDS are dominating right now. Operators are having to cater for all these, since it is driven directly by the viewer devices people want to use: iPads, Android tablets and PCs. Luckily MPEG-DASH has some similarities to the HLS format so we can hope for a bit more harmonisation as systems grow over time.

DTV Labs: Three players dominate the existing adaptive streaming market: Microsoft Smooth Streaming, Adobe HDS and Apple HLS. Microsoft and Adobe have thrown their weight behind MPEG-DASH (via the MPEG-DASH Industry Forum) and publicly declared their intent for their products to support DASH, while major industry players, such as Netflix, are also supporting the standard.

Apple's position is less certain and with the iPad/iPhone eco-system being so strong, content providers can't currently afford to ignore HLS. That said, solutions have appeared for MPEG-DASH to be converted to HLS on iOS devices, which means that the holy grail of reaching the vast majority of connected video devices with a single adaptive streaming standard is still a realistic possibility. Encouragingly, DASH has been adopted within HbbTV and OIPF, and there exist test suites and tools to minimise interoperability issues. There are still many challenges though, and it needs to be remembered that MPEG-DASH is a large toolbox so it's still possible for a server and client to both 'talk' DASH but not talk to each other.

Farncombe: We are seeing that MPEG-DASH is being adopted across Europe, it will probably be the answer to interoperability for some countries and platforms.

Harris: Standards are the key to adoption of new technologies. Once these standards are accepted and equipment is developed to use for the transmission of video and audio, the test equipment then can be developed to ensure compliance to the standards.

JDSU: Adaptive Streaming or Adaptive Bit Rate (ABR) is an advancement over fixed rate streaming. Clients in the display device request file segments and play the stream by requesting segments from a server or servers via HTTP following a 'manifest' for content. **Mariner:** The advantages of adaptive bitrate technologies are without question, and so its adoption in a harmonised form, as best characterised by MPEG-DASH, is as desirable as it is valuable. Adaptive bitrate technology should form part of the common foundation of the IP video environment, allowing consistency while leaving plenty of scope for innovation and differentiation in the higher level service domain. If adaptive technologies had existed 15 years ago they would have become the natural choice for traditional IPTV, overcoming at a stroke the difficult but necessary trade-off of 'reach vs. quality' – a service provider dilemma which characterised early IP video deployments.

Pixelmetrix: The future will certainly be MPEG-DASH. However, like MPEG-2 encoding and transport before it, the standard helps with interoperability but does not solve all problems. For example, MPEG-DASH is primarily a transport mechanism which is codec agnostic. So, if the encoder and player don't match, you won't be able to see anything.

R&S: Although different companies push their own proprietary standards, MPEG-DASH could become a common solution across different platforms. MPEG-DASH has the advantage of being an international standard and should therefore be an ideal candidate for avoiding interoperability issues. Since MPEG-DASH offers a wide variety of profiles, full interoperability requires support of different profiles at the consumer end. The future will show if this is more widely accepted than multiple single solutions.

S3: The MPEG-DASH standard was published as an ISO standard in April 2012. S3 Group believes that this technology will see widespread adoption. It builds on existing widely deployed web infrastructure through its reliance on standard HTTP servers and this allows use of standard HTTP-based CDN networks for content delivery.

MPEG-DASH only addresses the encapsulation and delivery of the A/V content, albeit in a very flexible fashion. There still remains the challenge of testing the system level services which are built on top of this MPEG-DASH delivery and this will continue to require innovative test and monitoring solutions.

Witbe: Sure it can become standard because the market cannot adopt too many proprietary solutions (Apple, Microsoft, Adobe, etc). It's easy to say that Apple will stay, thanks to the market penetration it has reached with the iPad. Service providers cannot ignore Apple and its proprietary technologies.

The rest of the market is so fragmented that MPEG-DASH could change the game thanks to:
- DRM interoperability;
- new enhanced codecs and Variable Bit Rate approach

We invest a lot on such an approach in order to help service providers protect their assets.

Euromedia: **Broadcasters and service providers are increasingly offering 'TV Everywhere'. What are the challenges of ensuring QoS and QoE across a range of platforms and devices, in particular Smart TVs?**

Agama: 'TV Everywhere' offerings directly translate into a dramatic increase in both volume and variety of end devices, as well as in volume of asset versions and types of content. This obviously adds to the operator's challenge of understanding the customers' perceived quality due to the diversity of what is actually consumed and how it is delivered. The operator needs to be able to efficiently manage, control and evaluate the QoS and QoE of the different distribution platforms to customers consuming video in very different settings, all with their own potential problem sources. The key will be to have the insight
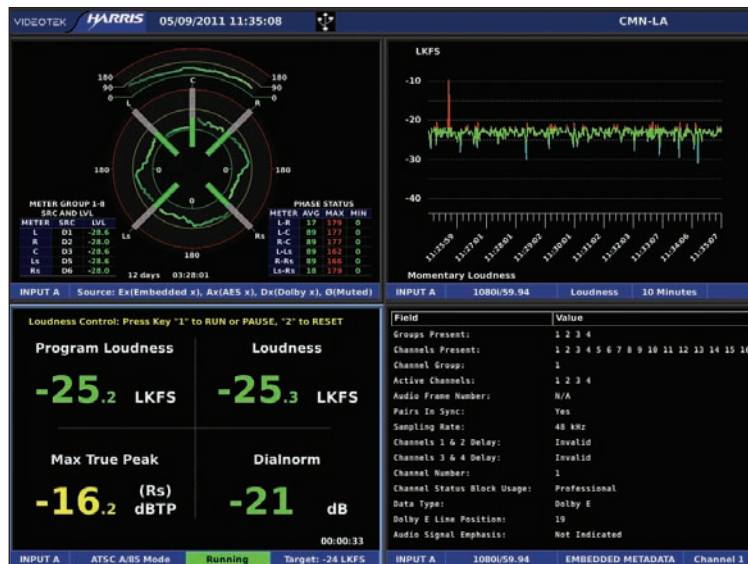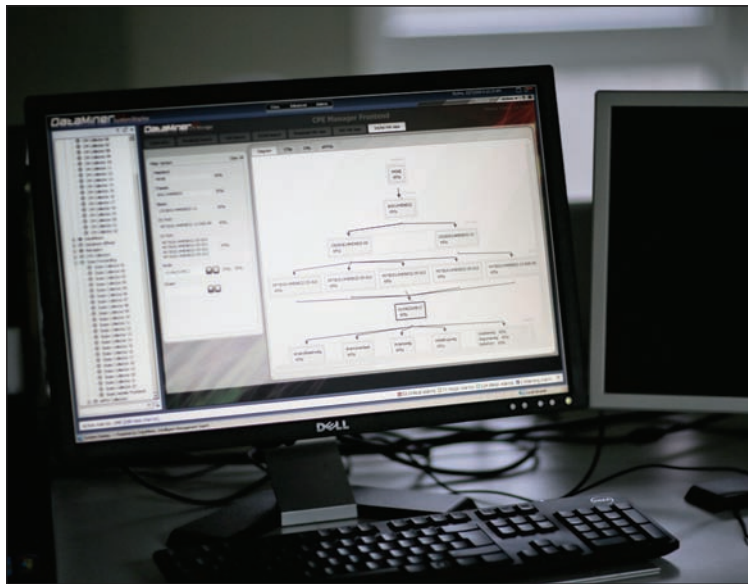
and actionable information that you can get from a modern, massively scalable QA solution that offers proper support to the operator's organisation with holistic top-level views and true transparency.

The particular case of Smart TVs is conceptually no different to us compared to other devices, but of course it adds complexity in all dimensions with lots of non-standardised end consumer devices.

Bridge: Lack of a single dominant standard is definitely one, effectively adding an extra dimension of complexity since in practice you have to build multiple parallel systems. Then there is overall signal delay: caching adds tens of seconds of transmission time, causing difficulty with live events. Fast zapping between OTT channels on a STB is another problem area. Then there is the distribution model: OTT is a unicast distribution of small video files with local file caching as close to the customer as possible to make it scale to millions of users. That caching is by broadcasters and service providers outsourced to Content Delivery Network operators (CDNs) in the hope that that will take care of the scaling.

DTV Labs: UI conformity and uniform service offering across platforms and devices are major challenges for broadcasters and service providers. There's a lot of effort (and money) being put into application development to ensure device-specific customisation to maximise QoE. In our view the model of porting a content providers proprietary app or player to multiple CE platforms with associated multiple software versions is unsustainable for all but the largest organisations, as to guarantee interoperability the testing efforts are immense. The success of key initiatives such as the Smart TV Alliance, and standards such as HbbTV and OIPF, will play a role in easing some of this pain. However, in order for content providers to have confidence in these standards and the interoperability of the devices they are deploying on, it's vital that certification test suites and programs are in place to ensure devices are really compliant rather than just claiming compliance.
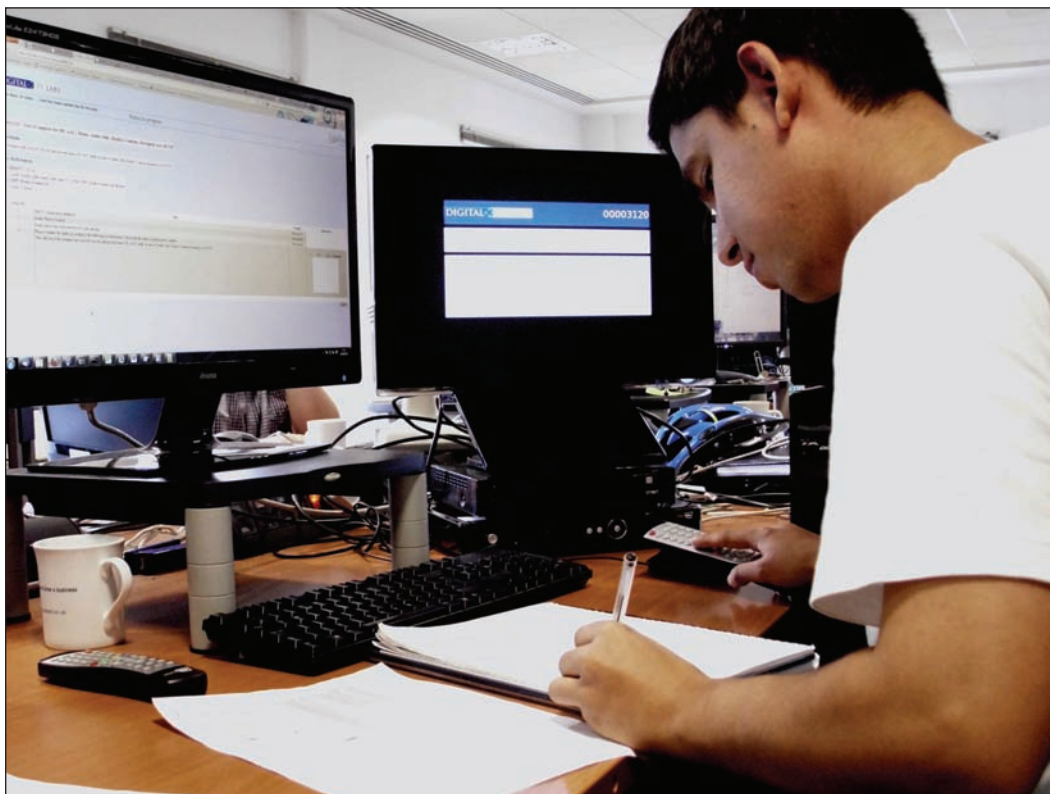
Farncombe: TV Everywhere presents a significant challenge to broadcasters and operators in that content is being offered on devices that are not under their control and often on networks where they don't have end-to-end control.

Operators can monitor the devices they provide and the networks under their control which can help build a QoS/QoE picture. One trend is that a growing number of operators are now routinely testing on some of the main uncontrolled devices to understand the experience that the end customer will have on Smart TVs and tablets.

Harris: The technology behind the TV Everywhere and other OTT providers is streaming over IP. Harris's Test and Measurement portfolio offers monitoring and analysis products for these sectors of the broadcast industry already. However, the key to QoS and QoE is to ensure that Test and Measurement is applied at the appropriate point in the workflow and any quality control issues are consistently addressed and corrected.

JDSU: Challenges include: Pro-active service management to check how end-user really experience the service. Measures real customer experience. Bring the customer view to the NOC. Capture personalised information at

the core, the edge, the home and the device. Remove Blind Spots in your End-to-End view.

Mariner: From a consumer point of view, TV Everywhere simply involves extending TV content availability to other screens. However, in addition to an explosion in the number and types of supported devices, TV everywhere typically involves different content storage models, media formats, communications protocols, streaming techniques and client paradigms than those employed in traditional IPTV. As a result, the established QOS and QOE techniques employed in IPTV are inadequate for IPTV. Indeed, the technology differences, when combined with differing consumer expectations of the second and subsequent screens, mean that the monitoring goals and expectations of TV Everywhere are different to those of IPTV.

Pixelmetrix: It all just gets more complicated. More points to monitor and more technology deployed in the chain – all while operating budgets are under pressure. In that environment, the solution can only be higher and higher integration, and automation of monitoring QA/QC functions to ensure a quality product.

R&S: TV Everywhere requires that content be delivered in different formats over different distribution networks (managed, unmanaged). Content is consumed on different types of devices. Ensuring QoS and QoE requires quality control of a much more complex system than a traditional linear broadcast system.

S3: Devices include Smart TVs, tablets, PCs and mobile phones as well as traditional and newer IP STBs. Together with the availability of cheap high-speed broadband, these devices are leading to the development of new classes of entertainment services and applications. One thing that has not changed is the importance of deploying reliable and stable services to customers.

One aspect that many of these newer devices have in common is that they are often purchased at retail rather than supplied by the service provider and it becomes increasingly difficult for the service provider to manage end-to-end Quality of Experience when 'their' equipment often stops at the IP Gateway. Nonetheless there seems to be a general consensus in the market that the service providers should continue to play a role in providing customer support into the subscriber's home across all the devices they are using to consume their services. This is driving the development of innovative solutions in the market to provide the operator's customer support staff with better remote access to diagnostics across all devices. TR-69 and its extensions are seen as an important element of the solution to this problem.

Skyline: The new generation of end-to-end multi-vendor network management platforms offers the ability to collect massive amounts of CPE-related data, and to cross correlate that data against a multi-dimensional model of the delivery infrastructure. CPE data can be sourced from a wide variety of sources, including the CPEs itself, the transport infrastructure, as well as (hardware or software-agent based) test and monitoring solutions. Because of the unique multi-vendor nature of this new generation of advanced network management platforms, there's less relevance whether that needs to be achieved via a standard (such as TR69 or SNMP) or vendor-specific protocol.

The new generation of multi-vendor network management solutions has the ability to easily adapt to any type of protocol, relevant for this purpose. And this can be done across CPE devices in the traditional broadcast plant, as well as the hardware or software clients in an OTT environment. The principal challenge these days is probably the lack of attention of the CPE solution vendors, to provide relevant and to-the-point metrics in relation to the quality of the services consumed on their platforms. And to some extent, the lack of native support for QoS/QoE metrics on a CPE platform is mitigated by dedicated third party software agents from specialised test and monitoring vendors. But that then typically does significantly complicate the overall management of the internal CPE ecosystem.

Witbe: The challenge is to work with an IP centric open minded technology. The traditional QoS approach is no longer suited because the transaction must be monitored, not only the stream or the health of one particular piece of equipment. If service providers want to reduce the cost of operations, they need ATAWAD monitoring technologies: AnyTime, AnyWhere (network independent) and Any Device (STB, Mobile, PC…). It's exactly what Witbe is doing.

Euromedia: **Functionality such as catch-up and start-over is becoming increasingly popular. Does this give rise to fresh challenges? What other challenges are on the horizon?**

Agama: In video distribution solutions with STBs, these types of time-shift services have been available for quite some time. However, we see less of hard drives inside the set-tops these days; catch-up and start-over features are increasingly being handled server based from central locations.

From a service QA point of view it requires a sophisticated end point monitoring set-up, offering continuous observation including time correlation to efficiently manage the service quality. This is something the Agama DTV Monitoring Solution has been commercially supporting for years, and it's nothing we consider a new challenge ahead.

One of the major challenges, today and in the future, is how to, as efficiently as possible, transform the massive amount of raw monitoring data gathered from all video distribution platforms into true business supporting information to the operator – and even more
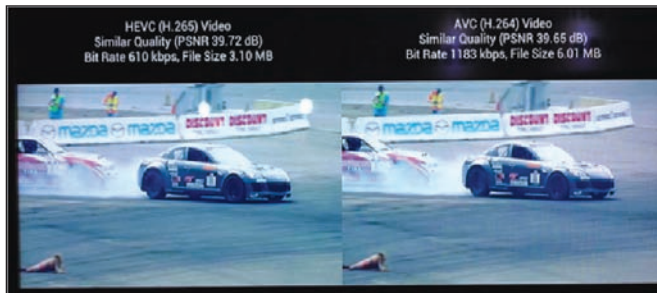
HEVC (H.265) Video Similar Quality (PSNR 39.72 dB) Bit Rate 610 kbps, File Size 3.10 MB — AVC (H.264) Video Similar Quality (PSNR 39.65 dB) Bit Rate 1183 kbps, File Size 6.01 MB

so in a massively scalable reality.

Bridge: Indexing content assets, facilitating easy searching, designing easy-to-use interfaces become important factors. From a business perspective, it is interesting to see how the old revenue streams from TV advertising are starting to find new outlets in OTT models. One thing is for sure: the moment serious money starts flowing through these new OTT infrastructures then the demand for quality and stability will increase accordingly!

DTV Labs: Catch-up and similar services have evolved from a PC offering onto mobile/tablet/smart TV platforms, and have created challenges and costs in transcoding, asset management, including metadata, content protection and UI/app customisation to cater for end device features (and limitations), as well as integration to systems such as Netflix and LOVEFiLM. The natural progression will be social media integration and value added content, both free and paid. The latter brings about issues involving payment mechanisms, DRM and integrated technology to cater for pay-once-view-across-multiple-platforms-and-devices.

Farncombe: End users increasingly expect catch-up TV to just work even when the provider is not deriving any revenue from the service. There is an ever-increasing challenge as to how users navigate to content which may be available to them via many means on the same device: linear broadcast, recorded on their PVR, catch-up service, On Demand service, OTT service. The challenge is to give the users the means to navigate and allow them to differentiate between the options available.

Harris: Functions such as catch up and start-over rely on IP, as long as there are robust QC procedures in place on the delivered content the customer will receive a consistent QoE.

As for the next challenge? Sometimes you can't see what the 'next big thing' will be, but with open and clear communications with our customers we feel ready to tackle these issues head on.

JDSU: This does give rise to fresh challenges in addition to the ones seen above such as: More signalling. STBs not mandatory anymore for IP Video so how to measure the customer experience without STB data models such as TR-135. Understanding what the customers are really trying to do.

Mariner: Consumers increasingly value and use facilities such as catch-up and start-over which have huge implications for network dimensioning. But technologies such as diverse routing and load balancing across multiple content sources introduce uncertainties which make predictive modelling difficult. Enhanced monitoring of the periphery of the network is an effective way to understand the impact of uncertainty, and to take measures to contain and manage it.

Pixelmetrix: We actually think the technology for these kinds of services is more mature than we believe. So, the problems, in fact, fall into some other existing category. For example, catch up is strongly based on VOD, which bears resemblance to IPTV and OTT technologies.

R&S: The rising usage of individual video services over fixed and mobile networks increases the bandwidth requirements. Handling these requirements will be one of the challenges. Usage of H.265 compression might help to handle the bandwidth requirements but it requires the implementation of a completely new compression system across all devices.

S3: We see a rise in on-demand services of all types across all forms of networks of which catch-up and start-over functionality effectively represent two more examples. This raises a challenge of ensuring that the content is always available through all the delivery channels that have been promised to the user.

In this new world where the content is ever more available, there is still the fundamental requirement to make sure that consumers are paying for what they are receiving and so the test and monitoring of end-to-end content security remains a big issue. This has become more complex in recent years as traditional pay-TV industry conditional access systems have had to be augmented and integrated with Digital Rights Management systems as the delivery chain has extended beyond the traditional STB and onward to a range of consumer devices.

Skyline: The new generation of end-to-end multi-vendor network management software platforms offers a key opportunity when it comes to service quality and availability management with the new ability to collect, aggregate and intelligently cross-correlate large volumes of CPE-related data on a 24/7 basis. The correlation is done on a multi-dimensional correlation model of the delivery infrastructure, and hence it supports the modelling of both traditional linear broadcasting services, as well as the new and increasingly more popular services such as VOD, catch-up, start-over, etc.

Witbe: Customers are asking for features letting them personalise services and transactions. It is a great opportunity for service providers to add value and stickiness to their services. But to enable transactions, and make them recurrent, trust is mandatory and quality is key to build that trust.

This totally changes the game for cable operators, for instance: We no longer live in a broadcast world, but in a transaction/IP-centric world. It's one of the market segments where Witbe is currently making huge progresses. Cable operators (as well as many telecom operators too) need to raise their transaction potential to the level of the best OTT service providers such as Apple/iTunes, Amazon, Google or Facebook.