Advanced File–Based Quality Control

Understanding New Developments and Market Requirements for Content Suppliers and Video Service Providers

WHITE PAPER

Date/Time Started			Container		Template		E	W	Time Remaining		Progress

Date/Time Added			Container		Template	Priority		E	W	Time in Queue	Progr

Job ID	Date/Time Completed	Container	Template	E	W
50038	3/16/2016 3:15:56 PM	HPC_pixel_issue.mov	pixel profile	0	0
40038	3/7/2016 4:59:40 PM	EST_TheXFiles416HD_EOT50811_mezz_LVLH07_v4.ts	Audio Channel Correlation	7	
30038	3/4/2016 11:24:21 AM	edge_east_LVLH03.ts	Quality Test	4	
30037	3/3/2016 10:51:34 AM	Big_Buck_Bunny.ts	Stream Summary Only	0	
30036	3/3/2016 10:35:08 AM	Big_Buck_Bunny.ts	Quick Scan		
30035	3/2/2016 5:01:03 PM	Big_Buck_Bunny.ts	Mezz Check HD		
30034	3/2/2016 4:07:00 PM	Big_Buck_Bunny.ts	Mezz Check HD		
30033	3/2/2016 3:08:30 PM	Big_Buck_Bunny.ts	Mezz Check HD		
30032	2/19/2016 9:39:37 AM	Fallon_pop_LVLS06_cut.ts	Audio Channel Correlation		
30031	2/19/2016 9:37:28 AM	edge_west_LVLH07.ts	Audio Channel Correlation		
30030	2/19/2016 8:54:38 AM	EST_TheXFiles416HD_EOT50811_mezz_LVLH07_v4.ts	Audio Channel Correlation		
30029	2/19/2016 8:56:26 AM	EST_TheXFiles416HD_EOT50811_mezz_LVLH07_v3.ts	Audio Channel Correlation		
30028	2/19/2016 8:52:47 AM	EST_TheXFiles416HD_EOT50811_mezz_LVLH07_v2.ts	Audio Channel Correlation		
30027	2/19/2016 8:51:03 AM	EST_TheXFiles416HD_EOT50811_mezz_LVLH07.ts	Audio Channel Correlation		
30020	2/16/2016 3:12:22 PM	edge_west_LVLH07.ts	Audio Channel Correlation		
30019	2/16/2016 10:23:02 AM	Fallon_pop_LVLS06_cut.ts	Audio Channel Correlation		
30018	2/16/2016 9:55:20 AM	Fallon_pop_LVLS06_cut.ts	Audio Channel Correlation		
30017	2/11/2016 10:22:09 AM	master-video.mxf	Quality Test		
30016	2/10/2016 4:53:12 PM	THEMAZERUNNER_west_LVLH07.ts	Blockiness		
30015	2/10/2016 4:55:40 PM	THEMAZERUNNER_west_LVLH03.ts	Blockiness		

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Introduction

Major advances in file-based quality control (QC) technology have arrived in time to provide suppliers of TV programming and motion pictures much-needed assurance that they can keep pace with evolving technologies and changing consumer demand.

The challenge of maintaining video and audio quality while increasing the number of delivery outlets has placed growing pressure on VOD and linear television supply chains, each adding a unique set of metadata, format and quality benchmarks. Complicating matters, the entire value chain must maintain distinct requirements across a growing matrix of categories, languages, display resolutions, color gamuts, contrast ranges and advertising support mechanisms.

While many production, post, and distribution workflows support a previous generation of automated file-based QC solutions, functional and speed requirements have progressed to where a new level of flexibility and efficiency in file-based QC is needed. Today's QC system must support:

- Expanded test suites to meet evolving regulatory, compliance, and distribution requirements

- Instant scalability to higher or lower volumes based on business needs

- Faster speeds to stay ahead of the delivery curve

- Automatic access to supplemental processing capacity to avoid system overloads

- Increased accuracy, flexibility and display responsiveness in manual review

- Rigorous scrutiny of performance across all Adaptive Bitrate (ABR) streaming modes

- New thresholds of file-based QC with 4K UHD, HDR, WCG, HFR content

- Flexible integration with diverse resources and workflows

Tektronix, the market leader in file-based QC, has fully addressed these requirements for all broadcast, cable VOD and OTT syndication environments with the introduction of its next-generation Aurora QC platform. As the backward-compatible successor to Cerify, the industry's first file-based QC platform, Aurora QC delivers unmatched performance in scalability, speed, and QC analytics with support for 4K, ABR and integration into cloud-based workflows.

Further augmenting QC operations, Tektronix has streamlined the manual review process with the introduction of a new multi-protocol playback tool, the Hydra player. When integrated into the Aurora QC workflow, Hydra accelerates the manual QC process at up to eight times normal speeds with unprecedented frame-accurate visualization of video, audio, metadata and other associated elements. Hydra, which can be used standalone or even with other QC platforms, also supports real-time playback of the Interoperable Master Format (IMF) Composition Playlists (CPLs) now being widely adopted by the major studios and video service providers such as Netflix.

For existing Cerify customers, Aurora QC enables a planned migration to vastly improved file-based QC capabilities without an upgrade charge or disruption of existing workflows. For new customers, the new Tektronix QC platform offers a lower cost point of entry into file-based QC at unprecedented levels of performance, ensuring they will be able to meet evolving QC requirements for years to come. For existing and new customers alike, Hydra represents a breakthrough not only in player performance, but in cost effectiveness as well.

In the discussion that follows we look at market trends that are driving more advanced approaches to file-based QC. We then examine in greater detail the capabilities Tektronix delivers with its Aurora QC and Hydra player system solution.

New Developments Impacting Content Suppliers' QC Requirements

The emergence of the broadband delivered Internet as a pervasive utility has fueled the Consumer dependency on smartphones, tablets and computers for accessing video and audio content anywhere, anytime. Facilitating this access and developing new experiences have created the opportunity for content creators, aggregators and application providers to capitalize on this infrastructure to monetize content investments, evolve consumption habits and prosper amid shifting viewership from legacy television viewing models.

THE NEW MULTI–DEVICE AND ON–DEMAND VIEWING PARADIGM

Looking at data gathered from hundreds of millions of online users worldwide, digital video publisher Ooyala recently reported video consumption on tablets and smartphones doubled between Q4 2013 and Q4 2014 and now accounts for 34 percent of all online video plays.[1]

As shown in Figure 1, a global study conducted by Accenture in 24 countries provides a breakdown of device preferences for viewing long-form content by age group, highlighting the dominance of preferences for viewing TV shows, movies and sports on devices other than the TV set among the 14-34 age groups worldwide.[2] As can also be seen in Figure 1, much of this viewing is on-demand whether through access to pure-play OTT outlets and TV Everywhere apps from MVPDs (multichannel video programming distributors) or via traditional VOD outlets.

Viewing Trends Long-Form Video				
Preferred Viewing Device for Long-Form Video				
Age	14-17	18-34	35-54	55+
TV Shows/Movies				
Computer	44%	47%	34%	23%
Smartphone	16%	11%	5%	1%
Tablet	16%	9%	7%	3%
TV	29%	46%	58%	64%
Sports				
Computer	31%	26%	22%	15%
Smartphone	18%	11%	6%	1%
Tablet	14%	7%	5%	2%
TV	26%	38%	47%	54%

Source: Accenture

Percentage of Consumers Sourcing Video Entertainment		
Age	18-34	35+
From Free Video Streaming Services	72%	40%
From Subscription VOD	60%	40%
From Pay TV	46%	58%

Source: TiVo[3]

FIGURE 1.

1 Ooyala, Q4 2014 Global Video Index, March 2015

2 Accenture, Digital Video and the Connected Consumer, April 2015

3 TiVo, 2013 Millennial Video Entertainment Survey, February 2014

The primary force driving consumption of long-form video online is subscription VOD offered by Netflix, Hulu, Amazon and a growing list of other global and regional players. According to Digital TV Research, SVOD subscriptions will increase from 117 million at year's end 2015 to 249 million by 2020.[4] OTT SVOD revenues are projected to hit $21.6 billion in 2020, up from $7.6 billion in 2014. In the U.S., according to Parks Associates, 57 percent of U.S. broadband households now subscribe to an OTT video service.[5]

The need to capitalize on these opportunities is obvious for premium video content suppliers who want to compensate for a loss of momentum in traditional linear TV viewing. Researcher ABI predicts just a 3.7 percent CAGR (compound annual growth rate) for pay TV revenue in the U.S. through 2020 compared to a predicted 24 percent CAGR for OTT subscription revenues through 2019.[6]

While linear TV is not growing, it is not disappearing overnight. The struggle for service providers is balancing a growing emphasis on quality audio and video plus the increased complexities of metadata for managing upstream workflows and downstream display devices. This is creating a scalability problem where more resources simply do not meet the delivery challenge.

THE INCREASE IN QUALITY BENCHMARKS THAT MUST BE MET BY CONTENT SUPPLIERS

The Proliferation of Requirements from Distribution Outlets

The expansion in the number of distribution outlets for premium video content poses major challenges for suppliers of TV programs and movies, who must apply QC processes that will guarantee their content reaches the consumer and the video and audio is good. Otherwise, as the number of distribution outlets multiplies, most with different sets of acceptance standards, the costs of bad quality content will result in churn as the consumer will go elsewhere for access to the content.

The Expansion in Testing Jobs

In all cases, the range of asset components that must be subjected to the QC process has greatly expanded, complicating such traditional basics as ensuring the quality and synchronization of video and audio, closed captioning and language subtitling and dubbing and adding to the range of metadata information that must be validated.

The quality and synchronization of video and audio payloads must be validated across multiple codecs and screen resolutions to deliver every file to each customer in the appropriate formats they use. Suppliers must be able to verify a wide range of container wrappers used in delivering their content to distributors. Confirming the accuracy of the metadata used in conveying the syntaxes of all these elements and a growing list of other elements has added to the QC workload as well.

Moreover, the amount of information carried by metadata has exploded. Distributors need to reach more diverse audiences, which has expanded the number of closed captioning, subtitling and dubbing streams that must be associated with each content asset. Use of metadata to track, manage, and automate processes is growing in prominence.

The Impact of Advertising

Another development adding to the QC checklist is the role of on-demand content in driving advertising revenues. Program suppliers and distributors need to be able to capitalize on ad tracking by Nielsen during the D4 and D7 day windows of exposure following broadcast airing, which has fueled increases in the volume of content TV networks are licensing to MVPDs' free VOD offerings.[7]

Dynamic ad insertion, often targeted to specific audience segments, after the C3 window expires, has also gained momentum. *(In 2007, Nielsen changed their measurement window for TV programs to include live plus the first three days immediately following broadcast. This is called a C3 window.)* As a result of these new advertising strategies, multichannel video programming distributors (MVPDs) must be able to verify ad insertion tables and proper alignment of IDR (Instantaneous Decoder Refresh) and EBP (Encoder Boundary Point) markers.

4 Digital TV Research, Global OTT TV & Video Forecast, June 2015

5 Parks Associates, press release, January 2015

6 Rapid TV News, "Pay TV to Inch Upwards while OTT Rockets," April 2015

7 Bloomberg, "TV Networks Offering More On Demand to Reduce Ad-Skipping," September 2014

QC Challenges Posed by Adaptive Bit Rate (ABR)

Broadband delivered Internet has played a critical role in the exponential increase of video and audio content consumption. Since the majority of broadband is based on hybrid fiber coax (HFC) physical infrastructure originally designed for delivering cable television (CATV), the term Over-The-Top (OTT) has been given to Internet delivered video content. However, most broadband technologies are unable to provide the consistent level of bandwidth required to stream video without noticeable artifacts or errors. ABR was created as an enabling technology designed to overcome this problem. Intelligently delivering the highest video resolution that the delivery network could provide within 2 second increments, ABR streaming imposed new requirements on QC analysis. Preparing multiple files for each resolution and format type of a single title significantly increased the QC workload. Compounding this problem, the variety of display Operating Systems and rendering types including Apple HTTP Live Streaming (HLS), Microsoft Smooth Streaming, Adobe HTTP Dynamic Streaming (HDS) and MPEG DASH must also be supported .

The Need to Prepare for 4K UHD and HDR

The emergence of 4K Ultra High Definition (UHD) and High Dynamic Range (HDR) technologies adds additional dimensions to the existing ecosystems. While often paired in industry discussions, preparation of content for 4K UHD and HDR involves separate sets of new parameters that must be subjected to QC processes along with the other elements outlined above.

4K UHD has become a growing presence in the services offered by distributors, especially those in the pure-play OTT camp. Expectations are that 4K TV set penetration will continue to soar, reaching 10 percent of households in the U.S. by 2020, according to Strategy Analytics.[8] The research predicts worldwide 4K display shipments increased by 633 percent in 2014 to reach 12.1 million units and predicts increases to 27.5 million units shipped in 2015 and over 100 million in 2018.

As of mid-2015 Netflix subscribers paying a premium subscription price of $11.99 per month had access to 4K versions of the provider's original programming and a growing package of 4K-formatted movies. Amazon Prime, too, had launched 4K with a relatively large portfolio of movies along with its own original series and other TV shows, offered at no extra cost to Prime Instant Video subscribers, who pay $99 for full-year Prime service. Other online providers in the early stages of offering UHD content include M-Go, Vimeo and YouTube.

MVPDs are making early moves into the market as well. In the U.S., Comcast is expanding initial "Xfinity in UHD" offerings targeted to Samsung TVs with the addition of more titles and introduction of a new X-1 4K-capable set-top box.[9] In Europe, Liberty Global, BT and Sky are in various stages of introducing new 4K-capable set-tops as well.[10]

Ensuring 4K UHD content meets the ecosystem requirements requires QC processes that can determine that files meet customer specifications, whether they were originally shot in 4K UHD or converted from other formats such as 35 mm film, the cinematic version of 4K or 1080p HD. It's also important to note that content suppliers will need to be able to use advanced 4K-capable QC to gauge the effectiveness of the 4K up-conversion processes available to them, such as upscaling, various types of scanning, film grain filtering, artifact removal and color re-grading.

In this new environment, specifications may vary according to how a content provider and distributor commercially positions 4K content, where the threshold for quality might be lower for up-converted HD content versus content originated in film or 4K. Such variations might come into play, for example, with implementations of different tiers of service tied to variations in release windows.

8 Multichannel News, "4K TV Market Set to Explode," March 2015.

9 ScreenPlays, "Holding Back on UHD Services not a Good Option for MVPDs," February 2015

10 Broadband TV News, "4K Sky Box within Weeks," June 2015

Additionally, quality variations may depend on the bitrate thresholds set by distributors, which presently range anywhere from 15 Mbps to 25 Mbps for transmitting HEVC-encoded 4K content. Suppliers must be able to verify that quality requirements have been met at the customer's chosen bitrate threshold in accord with whichever HEVC profile the customer prefers – Main, which supports 8-bit color with a sampling depth of 256 levels, or Main 10, which is designed for 10-bit color processing with 1,024 sampling levels. Variables tied to these HEVC profiles also include chroma subsampling levels at 4:2:0, 4:2:2 or 4:4:4. And, of course, questions of whether ancillary content elements, such as UI graphics, text and ads, conform to the 4K quality parameters must be addressed by the QC process as well.

Adding to the intricacy of managing QC processes is HDR, which goes beyond the spatial resolution benefits of 4K by breaking with the Standard Dynamic Range (SDR or ITU REC 709) specifications revised for HD over 20 years ago. The various HDR modes now vying for market acceptance all have in common the support for a much wider color gamut and much greater contrast dynamics with deeper levels of black in the darker pictorial elements and far greater luminance in the brightest white and color elements.

The competing approaches to HDR are characterized by variations in contrast ranging from 2,048:1 to multiple factors above that and by variations in color gamut ranging from 757 million to 69 billion colors. Some HDR systems rely on use of 10-bit encoding while others require 12-bit encoding. The latter typically entail sending two payloads, one a baseline picture conforming to REC 709 to accommodate viewing on non-HDR sets and the other a metadata overlay conveying enhancements to be executed by display systems that can support REC 2020.

Efforts to sort all this out into a set of industry standards have made significant headway, but there are many initiatives underway that will have to be brought together if there's to be true standardization. Meanwhile, content owners and post facilities will have to be prepared to apply QC processes to a variety of HDR modes, depending on which ones their customers choose to support.

These requirements have entered the near-term horizon. Amazon became the first wide-scale distributor of HDR-formatted content in Q3 2015, while Netflix was publicly committed to begin delivering HDR before the end of 2015.[11] During 2016, similar plans are taking shape as standards, de facto or regulated, are implemented throughout the production, post and distribution pipeline.

11 CNET, "Amazon Beats Netflix to Deliver HDR Video," June 2015.

A QC Solution Suite Fully Adaptive to New Market Requirements

Clearly, the current requirements of file-based QC processes call for advances that go well beyond the capabilities achieved with the first generation automated QC systems. With far more elements to address in the QC workflow, content suppliers must be able to expand automated testing at accelerated speeds. Simultaneously, the ability to quickly perform manual review, make decisions, and investigate root cause analysis increases demands on the human element as well.

In response to these needs, Tektronix has developed the high-speed, highly automated Aurora QC platform. Aurora allows customers currently utilizing the Tektronix Cerify QC platform as well as new customers to address all the requirements enumerated above with unprecedented speed and accuracy. Equally important, Tektronix has introduced the advanced frame-accurate Hydra player, a breakthrough in QC support that enables content suppliers to accelerate and expand the range of manual review procedures in the QC workflow with playback on PCs and monitors from a wide range of source files, containers and codecs.

AURORA QC

Accelerating and Sustaining QC Test Speeds

Aurora overcomes the drawbacks that have inhibited the acceleration and expansion of QC processes on other file-based QC platforms (Figure 2). Through configurable allocations of CPU and GPU resources in high-density virtual and blade environments, Aurora's guaranteed QC capacity architecture supports concurrent analysis of more file types at much faster rates than previously possible.

Our flagship Aurora Professional VU platform enables the utilization of up to eight CPU cores and two GPU blades per VU to perform analysis of HD files at up to 4.5x faster than
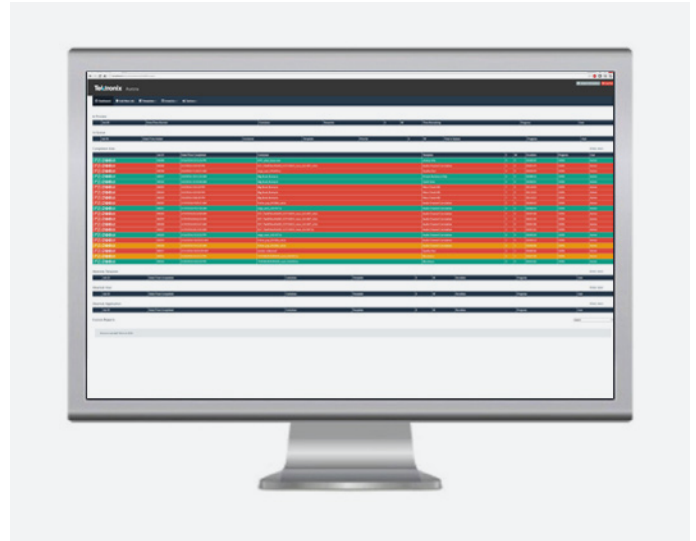

FIGURE 2. Aurora greatly expands the range, speed and scalability of QC applications with comprehensive report analytics.

real-time, with all tests enabled. All the testing required for 4K files can be performed at up to 2x faster than real-time.

Tektronix also offers an Aurora Premium VU that can dedicate up to 16 CPU cores and practically unlimited number of GPU blades per VU to achieve even higher speeds. At the other end of the portfolio spectrum, the entry level Aurora Core VU system can tap up to four CPU cores to deliver QC throughput on HD files in real-time.

In contrast to other systems, where the addition of more QC jobs slows processing speeds and can risk system overload, the Aurora Controller intelligently manages the job queue, optimizing available processor cores and job order based on user defined priorities. As a result, customers can expand workloads on each Aurora Verification Unit (VU) with assurance they will not overload the system, avoiding the need to repeatedly modify templates to optimize system performance.

Scalability and Efficiency

Aurora supports unmatched levels of scalability in the implementation of new QC jobs and VUs. Through the QC job queue, the Aurora Controller can allocate each QC job across its available VUs and processor resources. The Controller can add VUs to the system as needed, enabling scalability with increased file-testing throughput to a nearly unlimited number of VUs. In addition, customers can deploy multiple Aurora Controllers to manage groups of differently configured VUs in conjunction with setting multiple QC analysis speeds to prioritize processing of different categories of files or the test point location in the overall workflow.

Aurora also achieves higher efficiency in the testing processes by employing techniques that eliminate false positives and maintain a high degree of correlation to human perception, ensuring that only the significant issues are highlighted in test reports. Such capabilities will become increasingly important as tests are applied to all the nuances associated with QC over 4K UHD and HDR-enhanced content.

Aurora supports the full range of video, audio and metadata tests that are essential to maintaining QC on all asset files from SD to 4K. Utilizing the Smart Test Plans feature, operators can configure automated workflows to apply different sets of tests to specific files, including configurations of the tests specific to the Digital Production Partnership (DPP) AS-11 (a new UK specific file constraint).

The New Normal in Auto QC

Time changes everything. Only a few years ago, the quality of multi-screen audio and images rarely qualified for any, let alone equal, quality control efforts. Around the same time, the thought of widespread 4K UHD was considered a play thing of the major studios but rarely suggested elsewhere. Finally, as the business of video entertainment grows more complex, the industry has taken the initiative (arguably led by those whose painful experiences preferred not to have the industry share in…) to cooperatively utilize broad based standards and implement practical specification models focused on constraining the growing disparity and customization that is raising costs and overly complicating the very workflows intended to simplify our world. Where 4K is concerned, Aurora supports IMF-based QC analysis. When pointed at the asset map or any of the CPL assets, the system automatically parses and tests the CPLs and provides the results in a QC Test Report.

Aurora can execute 4K tests in real-time or faster across all codecs and containers, including JPEG 2000, HEVC and DPX as well as the various AVC permutations of H.264. For example, utilizing GPU acceleration, Aurora with the Advanced Codec Pack can perform 4K essence tests on JPEG 2000 files at speeds of 24 frames per second in real-time.

Aurora, for the first time in an automated QC process, also allows content suppliers to verify that their assets will be conveyed as expected over ABR streaming platforms. Such testing, performed at the same rates used with other tests in the QC workflow, is now possible owing to the much higher processing speeds that can be achieved with Aurora.

The Aurora ABR QC process employs all the fragmentation and manifest parameters used by the leading ABR systems, including HLS, Smooth, HDS and MPEG DASH as well as configurations specified by Netflix, CableLabs and other entities. All the asset components in each file are paired with the appropriate manifest to enable verification that those components will play out as intended in the ABR stream.

Cerify and Third-Party Workflow Compatibility

Aurora is fully compatible with the Tektronix Cerify QC platform, the first and most widely deployed file-based QC solution. Customers can seamlessly integrate Aurora into their Cerify workflows, enabling substantially faster performance on all previous Cerify tests and new ones as well. Aurora provides Cerify customers a direct link into Hydra and allows them to sustain connectivity via CeriTalk APIs or Cerify XML into third-party applications.

Aurora will expand on the QCloud capabilities of Cerify by allowing customers to flexibly use public and private cloud resources for Aurora QC processes, including operations in fully virtualized hybrid environments. Along with supporting Aurora QC with Amazon Web Services, Aurora is also capable of running on providers such as Azure Media Services and SDVI. Such resources can be used on a perpetual basis or on a per-use basis when extra burst capacity is needed.

Flexible use of Aurora also extends to integration with third-party workflows. Benefitting from work with Cerify, Aurora can be readily integrated into Telestream, SeaChange, Harmonic, Snell, Dalet and other workflow environments. Aurora's WSDL based SOAP API ensures that most new integrations can be designed and quickly implemented.

THE HYDRA PLAYER

Speed and Versatility

Complementing the advanced processing capabilities of Aurora QC, the Hydra player was built from the ground up to provide frame accuracy, access speed and versatility in the review and playback of video and audio files. While designed as an integral component of the Aurora QC workflow, Hydra is also a high performance manual QC player that can be operated either standalone or with other file-based QC solutions.

Hydra reduces manual review time to a fraction of the time it takes with other playback systems. When used with Aurora, the player allows customers to select any issue from an Aurora QC Report for playback through Hydra. Or they can access the full list of QC issues detected for a given file as displayed in the Hydra Review Bar and toggle from one to the next with no time wasted looking for the right start frame in the reviewed segment. During the review process customers can add annotations and make QC decisions for each issue as they view the playback, all of which are saved back to the Aurora XMLQC Report.

Hydra supports this rapid visualization process with no chunking or delays, replicating a linear viewing experience across all asset categories, including video, audio, captions, subtitles, text and metadata. The player can display these visualizations from multiple file formats on PCs or video monitors via SDI playout. (See Figure 3 for the list of file formats supported by Hydra.)

No other QC player in this price range offers the breadth of file versatility. Hydra uniquely supports direct access to content wherever it's located, including origin servers or archives without requiring rerouting to dedicated in-house servers. This also applies to playback of native camera files in instances where QC testing is performed as video is ingested into the production workflow from the field.

Adding to the versatility, Hydra can be easily implemented in third-party workflows utilizing purpose-built APIs to facilitate integration of all relevant workflow applications into the Hydra system. This enables customers to replace existing QC players with Hydra with assurance all the Hydra playback functions will be available to them, even if they choose to engage with Hydra

File Formats Supported by Hydra	
Video Codecs	H.264 (AVC/AVC-Intra), MPEG-2 (including XDCAM, IMX and D-10), ProRes, JPEG 2000, DNxHD (VC-3), Cineform (VC-2), VC-1 (and WMV), DV/DVCPro, Flash VP-6/7, RAW (Huffman, YUV, RGB, Blackmagic), RED, EXR, DPX, Canopus, HEVC.
Audio Codecs	PCM Audio (WAV/AES/BWF), Dolby Digital (AC-3), DD+ (EAC-3), Dolby TrueHD (MLP), Dolby E, AAC, HE-AAC, WMA Standard/Pro, MPEG-2 (L1,2,3), MPEG-1.
Container Wrappers	MXF (All OP, including AMWA defined AS, RDD-9, P2, SxS), Transport Stream, Elementary Stream, Program Stream/VOB, AVI, WMV/ASF, QuickTime/MOV, GXF, MP4, 3GPP, LXF, R3D, DPX, DXW, HLS, DASH, Smooth Streaming, IMF, DCP (unencrypted), HDS.
Captions/Subtitles/Text	Line 21, CEA-608, CEA-708, Timed Text / DFXP, EBU Subtitles (including STL), SRT, SCC, WebVTT

FIGURE 3.

through their own workflow UIs. Hydra also supports multiple hardware control surfaces such as Video Display Controllers, Contour USB Shuttle Pro, BUF shot boxes, etc.

4K and ABR Playout

Customers can take advantage of the HEVC-compatible Advanced Codec Pack for manual reviews of 4K UHD files on PCs and SDI monitors. As previously mentioned, Aurora supports QC analysis utilizing IMF with 4K. In Hydra, users can scrub back and forth among CPLs and can look at the exact 4K frame of any reported QC issue.

As is the case with Aurora QC, the Hydra player architecture is designed to enable users to make use of GPU as well as CPU resources. As a result, Hydra can play out higher resolution files and process more complex wrappers than is possible with other players, which is especially important in the 4K QC review process. This includes handling IMF CPLs for 4K playback in real-time.

Hydra also offers playout of HLS, HDS, Smooth Streaming, and MPEG DASH file sets into the manual review process. Hydra accesses results of tests specific to identifying the causes of ABR streaming problems and jumps to the exact frames to enable review wherever issues occur.

Conclusion

The expansion of distribution outlets for premium content represents both a major opportunity and a challenge for the entire video and audio value chain. Whether content creation, packaging, wholesale aggregator or retail provider, dependable access and quality of experience are prerequisites for success in the highly competitive and unforgiving media markets of today. Consumer churn is now measured in seconds rather than months and years, exposing even the largest global media organizations to substantive revenue loss.

The proliferation of alternative displays, delivery mediums, and diverse content are offset by thinning margins and advertising dilution. Television Networks and Stations, MVPDs, OTT and new distributors yet to be defined must maximize their respective return on investment and business propositions in the most efficient, expedient and consistent methods possible. 4K, IMF, ABR, HDR, multilingual audio and closed captioning, descriptive video, interactive ads, synchronized multi-device applications and social interaction are moving beyond niche markets and each adds a layer of complexity, metadata, data and analysis that is critical to some portion of the value chain.

Tektronix has developed a broad suite of test, measurement, correction and analytic solutions, helping every entity in the Media & Entertainment value chain to keep pace with a changing market. The introduction of the Aurora file-based QC platform and the advanced Hydra player, extend automated Quality Control across new areas of validation while optimizing human resources in key areas that require intuitive decision making and perspective.

By virtue of its backward-compatibility with the Tektronix Cerify file-based QC platform, Aurora provides a painless, no-cost upgrade path to advanced QC capabilities for existing customers. And it offers a surprisingly low-cost point of entry for new customers.

Hydra sets new performance levels in QC player technology, providing the speed and flexibility in the manual review process needed to avoid legacy bottlenecks and keep pace with high demand cycles. Hydra delivers exceptional benefits when paired with Aurora QC and can be integrated into third-party workflows to create automated workflow processes across scaled out platforms on a local or global basis.

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