



MEDIA TECHNOLOGY GAME CHANGERS

D I G I T A L C I N E M A



ACES

Why is it important? The Academy Color Encoding System (ACES) is a standardized motion imaging architecture and tool set for high fidelity motion picture imagery. ACES provides a number of benefits: it preserves the full range of highlights, shadows and colors captured on-set for use throughout the post-production and mastering processes; enables reliable and unambiguous interchange of images from all film and digital sources; enables future expansion of the creative palette by removing the limitations of today's legacy workflows; and uses a standardized file format suitable for archiving. ACES benefits cinematographers by preserving the use of traditional photometric tools; benefits visual effects and post-production facilities by enabling flexible workflow design and by simplifying visual matching of different cameras; and content owners by offering simpler remastering for multiple distribution platforms and by preserving the highest quality images for use with next-generation display technologies.

What are the challenges? Digital imaging tools have been in use for 20 years using standards from the 1990s. Transitioning from legacy tools and workflows to take advantage of ACES' high precision, expanded dynamic range and color gamut takes time. New innovations in cameras, displays and digital tools made possible by ACES will also take time, but they are showing up already.

Expectations for the future? Technological developments are expected to continue, and ACES' future-proof design encourages continual innovation in theatrical display systems, digital motion picture cameras and digital imaging tools.

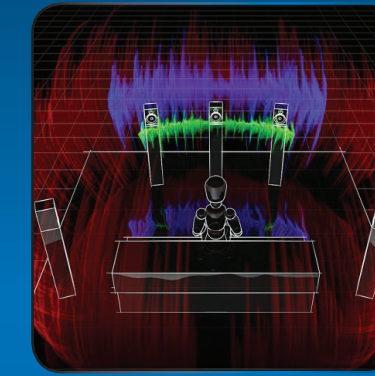


Laser Projection

Why is it important? Laser projection provides a number of image and business benefits. In image quality, it allows color gamuts that can go beyond the current P3 gamut in the future. In the short term, it offers the ability to deliver very consistent color reproduction. Laser illumination can also enable brighter 3D images as the power can be increased as needed to support the screen size requirements. In the short term, laser could be retrofitted to existing projector heads, but longer term, the lasers could reside in a "laser closet" and be fiber-optically delivered to the projector heads, allowing small, boothless installs. Most importantly, lasers last 20-50K hours—far longer than the 750-1500 hours from a Xenon lamp. While the lasers cost more up front, the longer term costs will be significant.

What are the challenges? Reducing the cost of the laser (more a matter of scale than technology) is an issue. Regulatory approval is also an issue, currently being addressed. Finally, getting the exhibitors onboard will be problematic, as many have invested new projectors that they will be loathe to upgrade to lasers.

Expectations for the future? Laser will eventually be adopted in theatrical, but this will take time. Other non-theatrical venues may adopt laser more quickly however. Lasers are already in use in lower lumen projectors such as hybrids. In 10 years, it is likely that all but the most value-oriented projectors will be powered by lasers.



"Immersive" Object Based Audio

Why is it important? Object-Based Audio is a next step in creation and delivery of PCM audio that promises to increase the sense of immersion by adding a height dimension. Object-based audio delivers the audio sources or "objects" themselves along with metadata that describes when the audio objects play, how loud they play, and where they are located in the playback environment. One benefit is that a single "mix once" presentation can be mastered that can be rendered to any number of speakers in a given playback environment. A wider frequency response and more headroom can be provided in all of the rendered channels compared to current systems along with a better fit with 3D imagery.

What are the challenges? On the content creation side, new tools are needed for mixing, mastering, and authoring processes. Currently, content providers may need to produce multiple versions for release due to the lack of a common distribution format. On the exhibitor side, additional sound processors, amplifiers and speakers are required, which can create installation and cost challenges. This can be somewhat mitigated by the scalable nature of these systems.

Expectations for the future? By providing a better marriage between the sound and picture, the storytelling opportunity is remarkably improved. Broad adoption in cinemas can be expected within the next 5-10 years.

T E L E V I S I O N , B R O A D C A S T A N D D I S P L A Y S



Ultra HD

Why is it important? Ultra-high-definition television (UHD TV) is the next step in the natural evolution of enhanced broadcast imaging. There are two proposed levels of spatial resolution: 3,840 x 2,160 (UHD TV-1, sometimes erroneously called "4K") and 7,680 x 4,320 (UHD TV-2). UHD TV provides greatly improved image detail, allowing viewing from a closer distance. The result is crisp, detailed images and increased field-of-view, creating a more immersive viewing experience. Consumer Electronics manufacturers are counting on the improved image quality to drive TV sales. It is expected that UHD TV will also include other enhanced technologies, including wider color gamut, increased dynamic range, higher frame rates, and immersive audio.

What are the challenges? UHD TV requires more data to be transmitted, and will rely on new codec technologies, such as HEVC. Standards are yet to be finalized for the full UHD TV ecosystem, making delivery to the home difficult. There is limited UHD TV/4K content available, and producers have been slow to adopt the new technology due to the increased production costs. UHD TV is most impressive at a close viewing distance—about 1.5 times screen height. That means when viewing 5-ft from the screen, an 84-in. display should be used.

Expectations for the future? Standards organizations, CE manufacturers and some broadcasters have been very active in formalizing UHD TV as the next generation for television broadcast. It will find select niche applications within the next few years, but take up to a decade or more for widespread use.



OLEDs

Why are they important? Organic light-emitting diodes (OLEDs) are considered to be the next big thing in display technology. OLED displays offer saturated, wide color gamuts; high contrast images, wide viewing angles, and fast switching speeds. They can be manufactured in a wide range of sizes and resolutions, and can also be printed onto flexible substrates.

What are the challenges? Manufacturing yields remain the major obstacle to OLED technology. Currently, manufacturing yields for large OLEDs suitable for professional monitors and consumer televisions are only 25 to 30%. Moisture contamination of OLED substrates is a continual challenge. Also, the half-brightness lifetime of different OLED color materials varies widely, with dark blue currently rated at 5,000 hours. As a result, most of the OLEDs in commercial use are found in handheld devices with rapid replacement cycles, such as smart phones.

Expectations for the future? The yield issue will be resolved with time and manufacturing volume. At least one television brand is now selling a 55-in. OLED TV with 2K resolution for \$10,000 in Korea, and 4K OLED displays have been shown at the International CES. As plasma display technology winds down, manufacturers are switching to OLEDs to replace it, so more OLED monitors and TVs will be available by the end of 2013.



Production, Post, & Distribution Using IP

Why is it important? By employing IP networks for both content production and distribution, broadcasters can take advantage of the billions of dollars being spent to develop new technologies. IP networks also allow broadcasters to combine multiple signals on one IP connection, and to deliver signals to multiple destinations simultaneously. These gains in efficiency and flexibility will drive major cost reductions and increase the variety of programming offered to viewers located anywhere in the world.

What are the challenges? Video and audio signals are exquisitely synchronous, with tight timing tolerances that require uninterrupted transport networks to deliver high-quality viewer experiences. In contrast, IP networks are time-insensitive, and deliver signals using discrete packets of information. To permit video transport, new video and audio technologies must continue to evolve to operate well over discontinuous-time networks. Another challenge will be to reconcile the traditional world of linear, advertiser-supported television "channels" with the increased consumption of on-demand, viewer-supported video streams and downloads.

Expectations for the future? Currently, a great deal of work is going on within SMPTE to develop new standards that support IP video transmission, and technology suppliers will continue to provide innovative new technologies. This equipment will be needed to support new signal formats (including 4K and HEVC) on new networks (10GigE and wireless mobile) while still providing a high-quality viewer experience.

M E D I A D I S T R I B U T I O N C O N S U M P T I O N

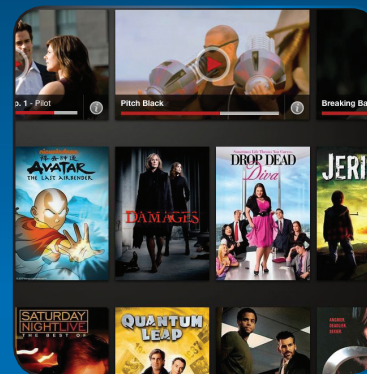


Mobile Devices

Why are they important? Today, everyone wants to view TV when they want, where they are, and what appeals to them at that moment. Thus, mobile devices and the delivery mechanisms to satisfy this insatiable appetite for content continue to be the best method to satisfy this appetite.

What are the challenges? First and foremost are the delivery mechanisms. Today, mobile devices and the technology embedded in these devices (MPEG 4/AVC, HEVC compression, Wi-Fi, 4G/LTE, ATSC-MH/DVB-T/CMMB/ISDB-T, dual/multicore processors, Apple iOS/Android OS) exist, but the value chain and business models have yet to be refined, to provide both content to the viewer as well as an eco-system that can support the economics of content production and distribution. A key difficulty is delivery of live content such as sports and news. These are the most demanding of content for delivery systems, requiring robust and reliable interconnections that will be difficult to support if the "other" type of content is not able to be monetized by the same networks and channels delivering live content.

Expectations for the future? Technology will improve the delivery mechanisms; however, the fundamental physics of delivery to the mass audience require "broadcast" modes of communications; communications networks and systems that require bi-directional data transfer will always underperform broadcast or multicast (one-way) communications. Yet, to enable the "anywhere/anytime" feature, there will be a requirement for a hybrid solution. Social websites/interactions (Facebook, Twitter, etc.) factor in as well in the marketing and organic growth of the content eco-system.



Over-the-Top

Why is it important? Over-the-Top delivery is in many ways the future of content consumption. Whether it's streaming to Internet enabled televisions, set-top boxes or delivery to mobile tablets and devices, OTT will fundamentally change the way consumers access content. In an always-on world, traditional broadcast television is competing with multiple sources for consumer attention. Apps, social media, chat, and text are now available 24/7 and routinely take priority over traditional content consumption. Viewers have become accustomed to constant interruptions and tuning in and out of programming.

What are the challenges? Content owners and broadband providers must understand and address these changes. Content monetization models must evolve beyond the antiquated notion of 30 second spots, which are readily skipped over, or ignored while the viewer engages with their mobile or other devices or people in the room. Broadband networks such as cable providers must scale to the task, embrace network neutrality, and scale to the challenge.

Expectations for the future? Leading Over-the-Top providers are now creating highly-regarded content that is only available via their services; these services will continue to draw consumers to OTT offerings. In the long term, a la carte programming models will prevail. Technology will enable new and more seamless interactions between commerce, content, and potential buyers.



Everything in the Cloud

Why is it important? Think of the Cloud as utility computing and storage. It offers agility, pay-by-the-sip pricing, massive scale, utilization efficiency, services, and reliability to the budget. Cloud suitability depends on the economic and technical needs for each use case. Some cases are a sweet spot for the cloud today (program distribution) while others will need to wait (live HD production). In the end, any migration needs to provide tangible technical and economic advantages.

What are the challenges? There is a light mist hanging over the public Cloud and it includes the challenges of security, vendor trust and lock in, deterministic performance, and reliability. These concerns will be mitigated as the cloud matures. Video is a demanding data type and not all cloud processes are friendly toward it.

Expectations for the future? Expect to see maturity of Cloud infrastructure, processes and management methods. Private, captive, clouds are media facility ready today. Each day brings more alignment of what the cloud can do and what our industry needs. Examine your facility needs and look for ways to get started and learn in the Cloud.

Thank you to our contributors: Chris Chinnock, Insight Media; Jim DeFilippis, Technology Made Simple; Al Kovalick, Media Systems Consulting; Pete Ludé, Consultant; Pete Putman, ROAM Consulting; Andy Maltz, AMPAS; Wes Simpson, Telecom Product Consulting; Hiroshi Shimamoto, NHK; Kevin Stec, Dynamic Digital Depth; Lance Ware, Cenoplex, Inc.

