SMPTE Annual Technical Conference & Exhibition 2017

Hollywood, California, USA
23 - 26 October 2017

Printed by Curran Associates, Inc. (2018)

For permission requests, please contact Society of Motion Picture and Television Engineers
at the address below.

Society of Motion Picture and Television Engineers
White Plains Plaza
445 Hamilton Ave STE 601
White Plains, New York 10601-1827
USA

Phone: +1 914 761 1100
Fax: +1 914 206 4216

www.smpte.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

Conference Program

8:00 AM - 9:00 AM   **Monday Morning Coffee - Ray Dolby Ballroom Terrace**

9:00 AM - 9:15 AM   **SMPTE 2017 Symposium Welcome**
Salon 1

Speakers: Michelle Munson,
Yvonne Thomas,
Richard Welsh

9:15 AM - 9:45 AM   **Understanding AI, Analytics, and Machine Learning.....N/A**
Not just an algorithm, it's about not really being able to reproduce results without the ML network.

Speakers: Richard Welsh

Session Chair: Yvonne Thomas

9:45 AM - 10:30 AM   **Keynote Address with Jeff Kember, Technical Director, Media, CTO Office, Google Cloud**

Speakers: Jeff Kember

10:30 AM - 10:55 AM   **How Digital Transformation is Changing Media & Entertainment with Machine Learning.....N/A**
Salon 1

How Digital Transformation is changing Media & Entertainment with Machine Learning, Content & Data Intelligence and Heterogeneous Integrated Workflows
The Media & Entertainment Industry is rapidly moving towards digital transformation in many categories around cloud-based workflow, all IP based broadcasting, metadata driven workflows, content intelligence, and machine learning for deep recognition of video-based data and meta-tags. The evolving challenge is to quickly adapt data integration and intelligence methods to enable automated workflows from content inception (data driven scripting and scene writing), content creation (origin content in editable file format with base metadata), content workflow (metadata driven workflow and multi-vendor uniform metadata structure, with workflow automation), content packaging and distribution (automated interchange between media creator and content aggregator/distributor), and finally IP based automated playout with hyper-focused user profile driven advertising insertion. The successful digital transformation of content creation and delivery will help drive better more profitable outcomes with shorter time to market and high impact effective content for attracting end user entertainment and consumption to increase the advertising area of effect and audience penetration. This will help all key stakeholders involved in content creation, processing, and distribution ultimately make better high quality, high resolution content that entertains audiences globally to maximize the revenue and intelligence of the constantly changing audience of news, sports, episodic, and cinematic content.

Speakers: Jay Yogeshwar

Session Chair: Yvonne Thomas

10:55 AM - 11:25 PM   **Monday Morning Coffee Break - Ray Dolby Ballroom Terrace**

11:25 AM - 11:50 PM   **Predicting the Future with Media Analytics Services.....N/A**
Salon 1
Thanks to the nature of OTT delivery, providers such as Netflix have access to a wealth of big data analytics that enable them to predict whether certain content will be successful and thus direct their investments appropriately and ultimately increase perceived value to the consumer. In doing so they have proven that media intelligence can add significant value to the media supply chain. This paper/presentation will examine how we can apply similar techniques in exploiting media intelligence to increase efficiency in journalistic workflows and be more effective in monetizing content. With a wide variety of technologies and services available, we will start by looking at what types of data sources, or combination thereof, add the most value. Next, we will address the steps needed to validate and ensure the reliability of data - ultimately determining a level of trust to ensure that "alternative facts" and rogue algorithms don't detrimentally impact workflows. The processes by which we nurture machine learning in the media ecosystem to ensure the continuous improvement and quality of generated data. Finally, we will look at how best to structure and visualize the data to users such that it can be quickly and easily consumed and therefore be of real benefit to the user. With such a huge amount of data, how do we avoid users being overwhelmed and instead furnish them with the ability to find and filter content based on intuitive search terms and context sensitive categorization. Key Takeaways - The available technologies - how can we

enrich metadata and guide production decisions - Ensuring the reliability of AI-generated data, nurturing the learning machines. - Visualizing the data - how to present large amounts of data in a way that makes workflows more efficient.

Speakers: Yvonne Thomas

11:50 AM - 12:15 PM   **Machine Translation of Timed Text: My Machine Can Read Faster Than Me.....N/A**
Salon 1

Machine generated translation is all around us - on the web, in our phones, on our tablets and computers, and moving into more devices and mediums every day. As machine learning processes continue to improve the quality of these translations, it will rapidly evolve and apply to uses that will allow more people around the world to enjoy localized content. The current limits of machine generated translations are highly palpable when applied to subtitles for video content. While algorithms can be used to successfully translate words, phrases, and sentences into other languages with increasingly improved quality, there are still many hurdles on the way to a viable solution to the industry's needs. The challenges vary, but can be boiled down to three main categories: timing, context, and consistency. Timing is affected by a few parameters. Readability, for example, is typically limited to 250 words per minute to maintain a comfortable reading speed for viewers. At the same time, subtitling formats limit line length to a specific number of characters. As a result, subtitle translations are adaptations that maintain intricacies of the meaning and intent of the dialogue in as few words as possible. Context is one of the biggest challenges. Dialogue that appears to be inflammatory on paper can have a completely different translation depending on whether a character is smiling or frowning. Sentence fragments, which are a common occurrence in dialogue, may have many variables on meaning depending on what's happening on screen or even the gender and age of the characters. These examples only scratch the surface of how context can be lost when using machine translation from text. Over time, machine learning will continue to improve timed text translations, but it remains to be seen how long it will take before it can be used to achieve the quality needed for video content. This paper will present examples and case studies that demonstrate the limits of current machine translation technology, while also examining how we can continue to use machine learning to improve the quality of translations. Additionally, it will explore how we can leverage the current state of machine translation through cloud-based web applications to aid human translators and bring higher levels of quality and efficiency to video localization workflows.

Speakers: Greg Taieb

Session Chair: Yvonne Thomas

12:15 PM - 2:00 PM   **HPA's Women in Post and SMPTE present a Women in Technology Luncheon-Ticket.....N/A**
Required (Vantage Room)

"Changing the Status Quo: Gender Bias in Media and Entertainment." The research that The Geena Davis Institute on Gender in Media performs centers around how media portrays women and girls and how negative gender stereotypes influence cultural and social behaviors and beliefs. Madeline will share the latest findings from Institute's new machine learning media metrics tool GD-IQ, Geena Davis Inclusion Quotient analysis of the top family films of 2017.

Speakers: Madeline Di Nonno

12:30 PM - 2:00 PM   **Networking Lunch by the Pool**
Loews Hollywood Hotel Pool Deck

Enjoy conversation with colleagues over a provided lunch.

2:00 PM - 2:30 PM   **Machine Learning Foundations (Theory and Practice).....N/A**

Thanks to the wide spread availability of web scale "big data" and advances in cloud computing, the development of Machine Learning software is becoming mainstream and cloud based Machine Learning services for applications ranging from automatic video indexing, to self-customizing "smart" user interfaces, to natural language processing are now offered by many major cloud infrastructure providers. However, while most media professionals have a sense of what "programs that learn" can mean for the industry, most have little to no background in the theory that underpins this new and rapidly growing field. This afternoon stream strives to provide a foundation for digital media engineers in the theoretical underpinnings of Machine Learning programs — what they are, an introduction to classes of both supervised and unsupervised learning algorithms, and examples of these techniques in practice covered by leading OTT and media content distribution technologists.

Speakers: Michelle Munson

2:30 PM - 3:00 PM   **Using ML to Predict Optimal Sources for Content in a Distributed and Heterogeneous Network.....N/A**

In this second part, Michelle will outline a new machine learning algorithm and implementation that applies continuous, multivariable regression to help predict the best (most optimal) source of content in a distributed and heterogeneous storage network. She will illustrate how multiple input variables ("features") can be used to model such systems based on resource availability on client and infrastructure sides and predict a client's quality of experience to select the most optimal path or resource provider. In the process she will describe the development process including the development of simulators to generate

training data, testing approaches to verify the quality of the ML program's predictions, and the development process learnings from prototyping to scale up.

Speakers: Michelle Munson

3:00 PM - 3:30 PM   **Monday Afternoon Coffee Break - Ray Dolby Ballroom Terrace**

3:30 PM - 4:15 PM   **Video AI: What's in Your Content.....N/A**

During this session, Martin Wahl, Principal Program Manager for Microsoft's Azure Media Services, will take the audience through the capabilities of its rich new AI-based video indexing service and give a view to its underlying machine learning models and cognitive services. Martin will demo how the platform allows users to achieve automatic metadata curation directly from uploaded video content including speech-to-text transcription and closed captioning, face and object detection, language translation – all of which can be used for automatic advertisement and content classification, dynamic adaptation of content based on audience preferences, and automatic creation of highlight reels and summaries based on detection of scenes, motion and people within a video. Martin will explain how the core technology is derived from underlying vision, speech, language, knowledge and search modules that Microsoft R&D has developed and now made available in a vertical platform API for next-generation media workflows both for video on demand and live broadcast scenarios.

Speakers: Martin Wahl

Session Chair: Michelle Munson

4:15 PM - 5:00 PM   **Content Intelligence on AWS**

Integrating Artificial Intelligence & Machine Learning Technologies into Cloud-based Media Workflows.....N/A

In our final talk, Konstantin, Principal Solutions Architect at Amazon Web Services, will take a deep dive into AI and ML in the cloud, illustrating how these technologies and services can best be used to enhance both new and existing content workflows. The talk will focus on three related topics - the Amazon AI service stack and broader AI/ML AWS ecosystem, deep learning and computer vision for media content processing, and machine-learning-based infrastructure and data security. First, the audience will gain a look into the Amazon AI service stack as well as ancillary toolkits such as MXNet, Tensorflow, OpenCV and related technologies and then learn pragmatic approaches to building AWS service-based deep learning solutions, and specific architecture design for topics such as sentiment analysis, facial recognition, and asset management metadata classification. Konstantin will show common best practices for integrating these services into asynchronous as well as synchronous event-based workflows, including common approaches to designing for performance, capacity, durability and availability. Finally, the audience will learn how these solutions and their artifacts can be continuously monitored, classified and secured using fully managed machine learning services.

Speakers: Konstantin Wilms

Session Chair: Michelle Munson

5:00 PM - 5:30 PM   **The power of AI – How AI Can Change our Business.....N/A**

While AI has become a trend there is much more behind the scenes. Owning big data and more important processing and understanding data becomes extremely powerful. Some experts fear that machines will take our jobs and even take over creative work. This panel will discuss new perspectives for the Media business enabled by AI, how to monetize data and the challenges for us humans "reign over machines".

Moderators: Seth Hallen

Panelists: Michelle Munson,
Martin Wahl,
Richard Welsh,
Jay Yogeshwar

5:30 PM - 5:40 PM   **Thank You and Adjourn**

6:30 PM - 8:00 PM   **SMPTE-HPA Student Film Festival (Ticket Required) - Chinese 6 (TCL).....N/A**

Official Selections will be screened at TCL Chinese 6 Theatres, located on Level 3 of the Hollywood & Highland Center. Jurors curated the Official Selections from 119 shorts submitted by student filmmakers from more than 30 countries. Hosted by Howard Lukk, director of engineering and standards at SMPTE, and Aimée Ricca, marketing and communication at SMPTE. The official selections will be presented in SMPTE Digital Cinema Package (SMPTE-DCP) format. Award winners for each category will be announced and presented at the festival. In addition, the Audience Choice Award will be voted on by attendees and presented at the conclusion of the festival. Tickets to attend the festival are available with SMPTE 2017 registration packages or separately as a ticket-only registration. Admission is free for students, and a $25 donation to benefit the SMPTE Education Fund is suggested for others.

Speakers: Alireza Bidar,
ChingTien Chu,
Weisi Dai,
Andrew Paul Davis,
Seth Hallen,
Le Han,
James Just,
Jiranant Kanjanagawin,
Ninaad Kulkarni,
Barbara Lange,
Vivian Lau,
Wei Li,
Howard Lukk,
Nicolas Medrano,
Derek O'Dell,
Gustavo Raskowsky,
Aimée Ricca,
Irina Rubina,
Meg Viola,
Joshua Walquist,
Richard Welsh,
Stephanie LI Yuqi

Tuesday, October 24, 2017

7:00 AM - 6:00 PM **On-Site Registration-Ray Dolby Ballroom Terrace**

7:30 AM - 8:45 AM **Tuesday Morning Coffee - Ray Dolby Ballroom Terrace**

8:45 AM - 9:00 AM **Opening and Welcome**
Salon 1

Speakers: Paul Chapman,
Thomas Edwards,
Matthew Goldman,
Sara Kudrle,
Barbara Lange,
Richard Welsh

9:00 AM - 10:00 AM **Opening Keynote - The Immersive Future: Broaden Your Horizons.....N/A**
Salon 1

Capturing and delivering content in 360° is expanding the rectangular window that has framed our past entertainment experiences. This ultimate field of view is the next natural step in a long progression of immersive storytelling meant to maximize viewer engagement. The challenges and advantages in capturing VR and AR elements are evolving for this kind of experiential delivery, and how the art form of traditional content coexists and overlaps with interactivity, artificial intelligence, and gamification of entertainment. We have the opportunity and responsibility to sustain the quality of narrative legacy and premium human craft of the best television, advertising, and movies of our past in the interactive, data-driven future. Delegates should attend the keynote to get a sense of the impending seachange where everything grows exponentially: file sizes, field of view, resolution, color gamut, storage requirements, bandwidth and compression demands, distribution networks, etc. Attendees will leave with a clearer sense of what immersive content is and what we can gain from shaping its successful implementation.

Speakers: Andrew Shulkind

10:00 AM - 10:30 AM **Tuesday Morning Coffee Break - Ray Dolby Ballroom Terrace**

Content Security - Salon 2

Content Security: Maintaining Positive Control of Media.....N/A
Salon 2
Chair: Marc Zorn (CSC, USA)
Date: Tuesday, October 24
Time: 10:30 AM - 12:00 PM
The industry continues to experience high-profile losses with all too much regularly. The threat landscape is expanding and becoming more and more sophisticated, so we need to institute more complex measures to meet it. This session explores three key areas that will help maintain positive control over media content until it is delivered. Digital Asset Management (DAM) helps to securely manage specific elements.
Blockchain helps to establish a consistent chain-of-custody. Stream privacy helps ensure delivery to the appropriate destinations."

Advances in Display Technologies - Salon 1

Advances in Display Technologies.....N/A
Salon 1

Chair: Peter H Putman (Kramer Electronics, USA)
Date: Tuesday, October 24
Time: 10:30 AM - 12:00 PM

Next-generation television (UHD+) will significantly improve our viewing experience, but creates new technical challenges (what a surprise!). How do you calibrate next-generation LCD and OLED displays to accurately display UHD content mastered with high dynamic range and wide color gamuts? How do you connect those ever-faster, high-bandwidth signals into the displays to begin with? And how do you provide live UHD broadcasts from a platform 200 miles high that's traveling 17,500 miles an hour?

This year's Advances in Display Technology session will answer all of these questions. Don't miss it!

Content Security - Salon 2

10:30 AM - 11:00 AM   **Blockchain & the Hollywood Supply Chain.....324**
Salon 2

The global system behind entertainment is opaque. It impacts content creators who do not know what, when, and how their content is consumed. Imagine the impact if all stakeholders had access to the same facts - Guilds, Unions, Studios, Record Labels, Publishers, Distributors, and Viewers. Blockchain technology offers this opportunity. In this article, we will explore new methods for enabling accountability in pre-production, production, post-production, distribution, and consumption with a secure chain of custody for Intellectual property, royalties and more.

Speakers: Steve Wong

Advances in Display Technologies - Salon 1

10:30 AM - 11:00 AM   **Engineering a Live UHD Program from the International Space Station.....355**
Salon 1

The first ever live downlink of Ultra-High Definition (UHD) video from the International Space Station (ISS) was the highlight of a "Super Session" at the National Association of Broadcasters (NAB) in April 2017. The Ultra-High Definition video downlink from the ISS all the way to the Las Vegas Convention Center required considerable planning, pushed the limits of conventional video distribution from a space-craft, and was the first use of High Efficiency Video Coding (HEVC) from a space-craft. The live event at NAB will serve as a pathfinder for more routine downlinks of UHD as well as use of HEVC for conventional HD downlinks to save bandwidth. HEVC may also enable live Virtual Reality video downlinks from the ISS. This paper will describe the overall work flow and routing of the UHD video, how audio was synchronized even though the video and audio were received many seconds apart from each other and down separate paths, and how the demonstration paves the way for not only more efficient video distribution from the ISS, but also serves as a pathfinder for more complex video distribution from deep space. The paper will also describe how a "live" event was staged when the UHD coming from the ISS had a latency of 10+ seconds. Finally, the paper will discuss how NASA is leveraging commercial technologies for use on-orbit vs. creating technology as was required during the Apollo Moon Program and early space age.

Speakers: Sandy George,
Rodney Grubbs

Content Security - Salon 2

11:00 AM - 11:30 AM   **Shoring up your DAM in the Cloud.....425**
Salon 2

This paper will discuss the ways in which Amazon Studios have approached the topic of Security within its' Digital Asset Management (DAM) system. Amazon Studios is 100% cloud-based, and have utilized a range of tools to ensure that it's Original content is protected. The paper will talk about the supply chain pipeline that Amazon Studios has implemented, the protocols and transport tools that it has utilized to provide secure yet cost-effective measures to protect assets. These assets include, but are not limited to: encryption, SSL, watermarking and digital forensics, access control, and AAA (Authentication, Authorization and Accounting. Security processes can be both procedural and technical, and Amazon Studios will discuss the three-sided approach that it has adopted to ensure the protection of its' content by inside and outside of its' own DAM: Technology, Vetting and Education. The paper will talk about Technology, primarily, including a discussion of the steps the DAM takes to secure content once inside the Amazon DAM, but also the technical steps that it has taken to ensure protection of assets into and out of the DAM. The final two sides of the triangle are "soft" implementations but nevertheless are vital to the success of any implementation. This means that the vetting and education pieces must be rigorous, and to be effective, have to be relatable to vendors and partners. The three-main take-aways will be: 1) How to deploy a DAM in AWS a. Figuring out your pipeline / end to end b. How to secure that pipeline c.

Ways to increase your security rather than lessen it 2) Technical steps to implementing raised security measures a. Encryption b. Watermarking etc… 3) The non-tech aspect a. Security is only as good as the users and contributors b. Making sure everyone understands the how, the what and the why c. Vetting the security of your vendors without being an intelligence agency

Speakers: David Ginsberg,
Callum Hughes

Advances in Display Technologies - Salon 1

11:00 AM - 11:30 AM   **Proposed Measured Display Characterization File for HDR Consumer Displays.....418**
Salon 1

The advent of wide color gamut (WCG) and high dynamic range (HDR) imaging has upended long-established standards for display monitors and changed the very definition of display calibration. With the ITU-R BT.709 standard, which in retrospect looks like a calm and pastoral monoculture, the nature of display calibration was straightforward: adjust the behavior of the video display until its output matched the standard as closely as possible. The changes created by HDR can be seen most clearly by describing the way HDR color volume mapping works: An HDR TV's color volume-mapping algorithm looks at the metadata that shows how the content was mastered, compares that metadata to the definition of the HDR TV's capabilities, and applies some very intelligent mapping to make the HDR content appear as accurately as possible on the TV. A new kind of calibration process is needed to provide color accuracy, while at the same time not affecting the intended behavior of the TV's Color Volume Remapping algorithm. No standard exists for the format or mechanism of this process. This paper proposes a standard for self- description in video displays that will allow mapping algorithms to best display a variety of HDR content on a variety of display devices with differing capabilities.

Speakers: Tyler Pruitt

Content Security - Salon 2

11:30 AM - 12:00 PM   **Stream Privacy.....452**
Salon 2

ABR TV and OTT service providers are resorting to end-to-end encryption to protect the privacy of their customers' viewing habits from unauthorized third parties. In addition, content providers are unable to control caching of their content by unauthorized third parties - potentially, violating content licensing agreements with respect to content conditions such as takedowns or sunset rules. Recent work [1] has shown that it is possible to discern the identity of a VBR-encoded stream by fingerprinting methods based on widely-available analysis software. It is important to be able to protect stream privacy without sacrificing bandwidth/storage efficiency and quality. Furthermore, it is important to be able to support caching of streams in a controlled manner for large-scale distribution. Existing workflows for ABR TV/OTT services where encrypted content is delivered using HTTP (using visible URL) does not protect the privacy of the viewer (ABR service user). Content is delivered with encrypted Segments and Manifests using HTTPS (invisible URL) to protect the privacy of the viewers. Content is delivered with encrypted HTTP headers and served from blind caches from CDN or Service Provider networks. The blind caches may be controlled by the Content Provider or CDN/Service provider. These workflows suffer from easy identification of content/video watched and associated metadata using fingerprinting techniques based on a content fingerprinting database created by crawlers. Content/Video delivered is identified in real time by using segment size of the (VBR) video Segments and other metadata that are identified and cataloged as part of building the fingerprinting database. In this paper, we describe mechanisms to guarantee stream privacy for both VoD as well as Live/Linear ABR workflows. These methods protect ABR streams over HTTPS (or QUIC) based delivery (using invisible URLs) as well as ABR streams over HTTP-based delivery (using visible URLs) of TV/OTT workflows (VOD, Live, nDVR and Catch-Up). The methods may be client-side, server-side, or a combination of both for invisible as well as visible URLs. We discuss the tradeoffs of each of these methods. References: [1] https://www.mjkranch.com /docs/CODASPY17_Kranch_Reed_IdentifyingHTTPSNetflix.pdf

Speakers: Raj Nair

Advances in Display Technologies - Salon 1

11:30 AM - 12:00 PM   **Display Interfacing 2017: Getting Around The UHD Speed Bump.....346**
Salon 1

The growth of UHD imaging and the additional of high dynamic range (HDR), wide color gamut (WCG), and high frame rates (HFR) are pushing display interfaces to ever-higher clock and data rates. We're testing the limits of copper wire interfaces and are now compressing display signals for the first time. The newest version of HDMI (2.1) won't be widely available for a few years and may require optical fiber connections at higher speeds. In the meantime, DisplayPort (1.4) is ramping up its bus speeds to new highs and adopting support for consumer video formats. And USB Type-C is forcing everyone to take a new look at how a 'smart' display interface should operate and what it should look like. Display interfaces truly are at a crossroads! is it time to move away from proprietary copper-bus interfaces for signal distribution? What speeds would be required for network switching and

distribution of display signals? This presentation will provide updates on the latest interface architectures and speed challenges, and will also consider network signal transmission through fast switches as an alternative connection method for Full HD and 4K / UHD content.

Speakers: Peter Putman

12:00 PM - 6:00 PM   **Exhibits Open at 12 Noon - Ray Dolby Exhibit Hall and Centennial Exhibit Hall**

Fellows Luncheon

12:00 PM - 1:30 PM   **Fellows Luncheon (Ticket Required) - Vantage Room**

Media Infrastructure (SDI, IP) Part 1 - Salon 2

Media Infrastructure (SDI, IP) - Part 1.....N/A
Salon 2
Chair: John E Ferder (CBS, USA)
Date: Tuesday, October 24
Time: 1:45 PM - 3:15 PM

During this session, we examine SMPTE's ST 2110 standard and its components. We will also discuss the implementations of IP for the production and distribution of media and the techniques used to optimize performance. The performance of SDI for UHD will also be addressed.

Advances in Immersive Storytelling Pt 1 - Salon 1

Advances in Immersive Storytelling VR/AR/MR & 360° Video Pt1: Understanding Immersive Storytelling......N/A
Salon 1
Chair: William Redmann (Technicolor, USA)
Date: Tuesday, October 24
Time: 1:45 PM - 3:15 PM

Many variations of interface-mediated experience are offered by VR and its extended kin, presenting different challenges and opportunities, both obvious and subtle, to the storyteller. New principles are being discovered and new tools are being developed, each teasing a content creator to explore its implications and make something breathtaking. This track is divided into two parts: Part 1 explores such principles and presents examples of wrangling with them. Part 2 presents leading edge technologies and tools ready to be applied.

Media Infrastructure (SDI, IP) Part 1 - Salon 2

1:45 PM - 2:15 PM   **NABA Media over IP Report.....N/A**
Salon 2
North American broadcasters are facing the challenging task of converting their traditional SDI infrastructure to IP based networks. At the same time, they hope to move from specialized hardware to commodity "Commercial off the Shelf" (COTS) equipment with software only applications which is a pre-step for virtualization and the move to the cloud. Organizations hope that this move will increase scalability, flexibility, agility, accessibility and security. It may also decrease costs. To help North American broadcasters in this transition the North American Broadcasters Association (NABA) which represents broadcasters from Mexico, the US and Canada, established the Media over IP (MoIP) Sub-Committee (SC). After a year of work, a NABA member survey and dozens of meetings the NABA MoIP SC published a report to the NABA Technical Committee. This report includes motivations for broadcasters to move to IP infrastructure, educational information about the state of the industry, organizational changes as well as conclusions on how to move forward. This work happened in coordination with other industry organizations to get a broad picture of activities regarding media over IP. NABA joint the JT-NM to participate in its efforts to harmonize efforts from various industry organizations. This presentation will update on the work done in the NABA MoIP SC, the MoIP report, its relations to other organizations, the results of the NABA member survey as well as the NABA recommendations and consensus regarding MoIP. It will also discuss next steps in NABA regarding MoIP and the plans to hold a workshop on MoIP.

Speakers: Thomas Bause Mason

Advances in Immersive Storytelling Pt 1 - Salon 1

1:45 PM - 2:15 PM   **The Immersive Experience Classification System.....460**
Salon 1

The Immersive Experience Classification System: A new, strategic decision-making tool for content creators. Since the initial introduction of the first customer-facing VR devices, the diversification of immersive technologies has been exploding. From 360 video to Virtual Reality, Augmented Reality, Mixed Reality, Volumetric and Computational Imaging to the introduction of haptic devices of increasing complexity, it seems that innovation in this field knows no bounds. From a content creator perspective, this can have a paralyzing effect: Which technologies have a future, which do not? Will new media be obsolete quickly? Will it have to be converted to be compatible with future devices? Which technologies are more suited for storytelling, education, exploration or gaming? Instead of defining experiences through technology (like VR/AR/MR), this paper uses four axes to classify immersion: Seclusion (how isolated the viewer is from the real environment), Navigation (how does the viewer evolve in the environment), Interaction (how does the viewer alter the environment) and Modeling (how is the environment generated). By ordering immersive technologies on those axes, and linking them to types of user experiences (i.e. passive storytelling, interactive playing, solitary exploration, etc...), it is easier for content creators to select the right combination of immersive technologies to achieve their goals. For example, if the creator's goal is to tell a specific story, the use of technologies with limited navigation and interaction options will be more beneficial. If the goal is to provide a simulation of a virtual world, a high degree of seclusion combined with high freedom in navigation and interaction will be preferred - but that combination would not be the best choice to provide a specific educational experience, for example. The immersive Classification System demonstrates that in immersive media, there are no right or wrong technologies. Each newly developed technology has a purpose; the goal is to match the content creator's objectives with the right combination of technologies, to provide the best experience to the user while achieving the goals of the creator.

Speakers: Pierre Routhier

Media Infrastructure (SDI, IP) Part 1 - Salon 2

2:15 PM - 2:45 PM   **Is SMPTE ST 2110 the New Standards Superpower?.....N/A**
Salon 2

Top three informational takeaways for the audience - Requirements of an IP system - What is ST 2110 and how it works - Why ST 2110 is so significant to the future of broadcastThis is tutorial paper.The industry has begun the shift from SDI to IP with initial deployments being based on SMPTE ST 2022, ASPEN, or IP Live. While each of these solutions has its merits, they also have limitations, such as not supporting breakaway audio, or not being fully standardized. With the move to IP, the industry has a set of requirements that an IP system needs to fulfil. None of SMPTE ST 2022, ASPEN, IP Live, Ravenna or Dante meet all the requirements. VSF Technical Recommendations 03 and 04 (TR03, TR04) were developed to address the gaps these systems had in meeting the requirements. e.g., breaking the video, audio and ANC essence data into separate RTP streams. While an improvement, TR03 and TR04 also did not meet all the requirements.SMPTE ST 2110 builds on the work of TR03 and TR04, has input from a wide range of industry experts and vendors, and addresses of the industry's requirements to create one standard to rule them all. Even before being published, ST 2110 has gained substantial market support, been included in the Alliance for IP Media Solutions (AIMS) roadmap and featured in the largest interop event in our industry's history. This presentation will explain what are the industry's requirements, what ST 2110 is, what it does, how it addresses all the industry's requirement and why it is so significant to the future of broadcast.

Speakers: Leigh Whitcomb

Advances in Immersive Storytelling Pt 1 - Salon 1

2:15 PM - 2:45 PM   **Story Presence & Perspective: A User Study of Story Presence in an Immersive Narrative Experience.....300**
Salon 1

Story Presence & Perspective: A User Study of Story Presence in an Immersive Narrative Experience tested with Variant Levels of Immersion.In recent years, there are many new emerging video formats available to storytellers. High frame rate, wide color gamut, high dynamic range, and visual immersion are prominent elements of emerging technology. As engineers provide these technologies and formats to storytellers, the next step is to explore how storytellers can optimally use these technologies and formats. Each emerging technology will have a particular element that can aid a story, but it will depend on the intent of the storyteller on whether to utilize a new format or whether sticking with traditional cinema techniques is sufficient. This research is a step to explore the best uses and practices of visual immersion.Immersive narratives experienced in Head Mounted Displays (HMD's), whether in real environments or computer generated, allow the participant to be visually immersed in the narrative story. This visual immersion provided by the HMD allows the participant to achieve a sense of presence, a sense of actually being there in a reality that is not their current reality. This sensation of presence could be achieved whether or not a narrative story is taking place. Therefore an alternate distinction is necessary to define the user's sensation of presence not only within the story environment, but also within the story narrative itself. This is called story presence. Story presence is a sensation that can be experienced in traditional cinema as well as immersive narratives. Traditional cinema does not use full visual immersion to induce story presence, yet rather a century of the developing film language has explored and outlined composition, editorial, and other tools to emotionally

immerse the viewer in the story. This study acknowledges three broad variables of immersion in narrative experiences: experience, environment, and existence. The narrowed focus of this user study is on using perspective as a tool to test the effect of active and passive experience on the sensation of story presence. Two active permutations of a narrative story will be tested against a controlled passive experience using a subjective questionnaire to collect data and analyze the user's experience. The narrow nature of the study is combined with a broad exploration and attempt to define the language for storytelling in immersive environments as compared to traditional cinema.

Speakers: Anna Dining

Media Infrastructure (SDI, IP) Part 1 - Salon 2.....N/A

2:45 PM - 3:15 PM   **Synchronization and Timing in ST2110**
Salon 2

The evolution to ST2110 brings with it an entirely new way to establish system timing, through use of IEEE-1588 PTP and SMPTE ST2059. This method is native to the IP domain and to the RTP transport and media synchronization used by 2110, and also provides virtualized legacy timing capability. Using this toolset, evolutionary facilities of any configuration of IP and SDI equipment can be built. This paper discussed the considerations in system timing using ST2110, including those which include SDI elements. It initially discusses how PTP delivers precision time across an IP network and how ST2059 uses this to virtualize any reference signal. It then explains the synchronization mechanisms of ST2110 including transport timestamps and media clocks, how streams are synchronized among each other and how they interoperate with PTP, and how timing of SDI and AES3 signals is harmonized with ST2110 streams. On this basis, system design is examined, with explanation of how ST2059 enables fluid evolution, using examples of both IP islands in an SDI infrastructure and SDI facilities using an IP fabric. Also covered are router switchpoint timing and latency considerations.

Speakers: Paul Briscoe

Advances in Immersive Storytelling Pt 1 - Salon 1

2:45 PM - 3:15 PM   **ARnold: A Mixed Reality Short film using Microsoft HoloLens'.....312**
Salon 1

ARnold is a mixed reality (MR) film built for the Microsoft HoloLens that takes place in the viewer's living room. The film uses the concepts of Spatial Mapping, Spatial Understanding, Spatial Audio, and World Anchors to place multiple scenes on the viewer's actual surroundings; and dynamically changes the storyline based on the objects in the room. ARnold takes these technological opportunities and applies them to traditional storytelling techniques to create a film that is uniquely suited for MR. The main purpose of this project was to explore whether telling personalized experiences with a viewer-chosen setting increases empathy and creates a deeper emotional connection with the story. This paper also discusses the technical limitations of Microsoft HoloLens along the lines of how it affected our entire development cycle and the different techniques we adopted to tackle this challenge. This paper provides a detailed overview of our entire development cycle from both a ! technical and creative standpoint.

Speakers: Chinmay Chinara,
Greg Feingold

3:15 PM - 3:45 PM   **Tuesday Afternoon Coffee Break - Dolby Exhibit Hall and Centennial Exhibit Hall**

Media Infrastructure (SDI, IP) Part 2 - Salon 2.....N/A

    Media Infrastructure (SDI, IP) - Part 2
Salon 2
Chair: John E Ferder (CBS, USA)
Date: Tuesday, October 24
Time: 3:45 PM - 5:15 PM

During this session, we examine SMPTE's ST 2110 standard and its components. We will also discuss the implementations of IP for the production and distribution of media and the techniques used to optimize performance. The performance of SDI for UHD will also be addressed.

Advances in Immersive Storytelling Pt 2 - Salon 1

    Advances in Immersive Storytelling VR/AR/MR & 360° Video Pt2: Tech for Immersive Experience.....N/A
Salon 1
Chair: William Redmann (Technicolor, USA)
Date: Tuesday, October 24

Time: 3:45 PM - 5:15 PM

Technologies for Immersive Experience Production & Distribution.....N/A
Many variations of interface-mediated experience are offered by VR and its extended kin, presenting different challenges and opportunities, both obvious and subtle, to the storyteller. New principles are being discovered and new tools are being developed, each teasing a content creator to explore its implications and make something breathtaking. This track is divided into two parts: Part 1 explores such principles and presents examples of wrangling with them. Part 2 presents leading edge technologies and tools ready to be applied.

Media Infrastructure (SDI, IP) Part 2 - Salon 2

3:45 PM - 4:15 PM   **Control Throughput and Latency for Multicast-based IP Routing Systems.....N/A**
Salon 2

The development of the SMPTE 2110 family of essence networking protocols allows the independent switching and forwarding of IP media streams on an element-by-element basis. Multicast flows in the IP network are typically used in order to allow streams to be sent to multiple destinations. IGMP (Internet Group Multicast Protocol) is the typical method for endpoints to subscribe to the streams they want, and to leave the streams they no longer require. Concerns have been raised in the industry about the suitability of IGMP for this task, and the applicability of SDN techniques as an alternative means to managing group memberships. Speed of switching signals is a particular concern.This session briefly explains Multicast and IGMP as background, and then presents data on the sustainable throughput (joins and leaves per second) and the latency (time from joining a multicast to getting packets) for several different switch platforms from different switch vendors. Results for IGMP are presented, along with results for various switch SDN API cases. Vendor names are anonymized in the presented results.

Speakers: John Mailhot

Advances in Immersive Storytelling Pt 2 - Salon 1

3:45 PM - 4:15 PM   **360-Degree Video Streaming and its Subjective Quality.....277**
Salon 1

Traditional challenges for deploying end-to-end streaming systems are made harder when considering 360-degree media content. One of these challenges relates to the lack of commonly accepted standardized methodologies for subjective 360-degree video quality assessment, especially oriented towards streaming services. The contribution of this paper falls in the area of subjective assessment of 360-degree video. From traditional standardized test methodologies originally designed for 2D/3D video, we tailored a methodology more oriented towards Virtual Reality (VR) streaming services. The methodology inherits a lot from existing ITU standards for video subjective quality evaluation. The additions incorporate the special properties of 360-video, namely omnidirectionality, as opposed to traditional video. With this goal in mind, a new metric called Similarity Ring Metric (SRM) is introduced. It measures the degree of similarity in watching patterns of a single subject or between different subjects for several subjective assessment tests. This metric enables an inclusion or rejection criteria for test results in subjective assessment sessions. We also present visual fatigue results related to a subjective quality experiment of 360-degree video

Speakers: Henri Toukomaa

Media Infrastructure (SDI, IP) Part 2 - Salon 2

4:15 PM - 4:45 PM   **Programmable Data Plane for Professional Media Networking.....403**
Salon 2

Programmable data plane pipelines are now available in line rate packet processors implemented in commercially-available Ethernet switches. This development can provide useful functionality for professional media IP networks. This new programmable pipeline can be accessed to provide functions not possible with prior commercially available Ethernet offerings. The programmable pipeline and the functionality it enables can now become a key part of an SDN controlled professional media network.SDN gives network operators programmatic control over their networks. In SDN, the control plane is physically separate from the forwarding plane, and one control plane can control multiple forwarding devices. But non-programmable data plane SDN APIs (such as OpenFlow) are limited by implementation decisions made in the hardware data plane, such as a fixed number and format of packet headers, and a fixed set of actions that can result from match/action tables. Also communication between the data plane and control plane results in a high level of latency between control decisions and re-configuration of the data plane.Programmable data plane technology enables a more flexible method of controlling packet processing that can be performed at line-rate. The packet processor parser can be programmed to extract any header desired, and match/action tables based on those headers can be more complex than in non-programmable switching solutions. One new application of the parsing of specific application-layer headers is frame-accurate video switching of SMPTE ST 2110-20 video flows based on the RTP timestamp. Also, if the data plane is programmed to extract ST

2110-20 video header fields, switching decisions could be made on sample row number and offset fields to selectively switch packets for video compositing.This paper provides descriptions of these applications in the P4 data plane programming language, discusses implementations of some of these applications on actual programmable data plane ASICs, and evaluates how far real implementations can be scaled up.

Speakers: Thomas Edwards

Advances in Immersive Storytelling Pt 2 - Salon 1

4:15 PM - 4:45 PM   **Case study: Bridging gaming and broadcast technology for high productivity production.....329**
Salon 1

Studio-based television production largely depends upon fixed sets. These are expensive to build, take place to store and are slow to erect.Virtual sets have long been proposed as the viable alternative, giving the benefit of effectively instantaneous implementation, boosting productivity in the studio. But traditional broadcast virtual studio systems have proved expensive and require long and detailed design stages, eliminating the cost benefit.Breathtaking realism beyond traditional virtual setSince April 2016, Groupe Media TFO, a not for profit organization primarily concentrating on French-language educational content and based in Toronto, Canada, has brought together a number of technical partners with the aim of creating a high-productivity, low-cost approach to virtual studios: the LUV (Laboratoire d'univers virtuels). It has implemented an innovative system based on the Unreal engine from computer games specialist Epic. This has enormous power to create and sustain detailed virtual environments. The realism of the graphics goes well beyond the traditional Chroma Key, virtual set or Ultimatte environment. The interplay between background and foreground (shadows, pure and clean edges, BG plates can cast shadows or cut through beams of BG generated light, etc.) is breathtaking.Multi-camera real time shooting with no post-productionThe Unreal engine provides more than enough processing power to maintain the required HD quality across a very large model in real time, so TFO can make short programs for its young audiences very quickly, or as live broadcasts. As well as slashing production costs, post-production is virtually eliminated. The result is that TFO is now creating as many as 40 short online videos, each in a different setting, in a single day.Affordable solution with high productivityThe Unreal engine is also free to use, so a large, global community of developers has grown up around the world developing models which are traded online at very low cost indeed. TFO estimates that, while a traditional physical set would cost around $80k - $100k to construct, it can buy ready-made, fully developed scenes from the community for between $15 and $50 - one-two-thousandth of the cost. Models can be photo-realistic as well as fantastical.In this paper TFO, Eric Minoli will discuss and demonstrate the technical challenges in using games technologies in broadcast applications, and how these applications are equally applicable in any genre of fast turnaroun

Speakers: Kuban Altan,
Éric Minoli

Media Infrastructure (SDI, IP) Part 2 - Salon 2

4:45 PM - 5:15 PM   **Parameters Affecting the 12G Performance of Digital Patching Systems.....368**
Salon 2

Parameters Affecting the 12G Performance of Digital Patching Systems; The ongoing transition from 3G to single-link 12G digital patching systems in the broadcast, audio and video industry has introduced new challenges requiring higher performance components. To optimize signal performance from input to output through coaxial transmission systems, it is helpful for engineers and users to familiarize themselves with the concepts of frequency dispersion, group delay, impedance discontinuities and reflections, and to understand how these ultimately affect the error-free transmission of information, which is crucial to avoiding intrusions and artifacts in the received video and audio. As signals move through digital patching systems, patching system design engineers must also keep their eyes on how time domain parameters affect the performance of jacks and other high-speed components within the patching workflow. This paper will analyze how these parameters affect the performance of 12G patching systems, explore the various problems that can be ant! icipated, and how to proactively mitigate them, by understanding every step of the signal flow in relation to the various components of the system. This paper will also detail the use of eye pattern graphs to visualize how noise and reflections in the signal flow may result in decoding errors, ultimately impacting the received image quality.

Speakers: Dimitrios Antsos

Advances in Immersive Storytelling Pt 2 - Salon 1

4:45 PM - 5:15 PM   **State of the Art Virtual Reality Streaming: Solutions for Reducing Bandwidth & Improving Video Qual.....439**
Salon 1

Virtual Reality (VR) applications typically require very high bandwidth of at least 15 Mbps to 20 Mbps, while providing limited video quality. This is because users only see a small part of the panorama of about 12 to 15 percent. But, the full panorama needs to be provided to users. This paper will summarize the state-of-the-art in VR streaming, detailing how Tiled VR

streaming technology can reduce bandwidth requirements by an order of magnitude while improving video quality. This is achieved by dividing the picture into "tiles" and streaming only those tiles that users actually see in head-mounted displays (HMDs). The solution is based on HEVC tiling features as well as the DASH extension. A major challenge for any selective VR streaming technology is motion-to-photon delay. Using a combination of selective tile transfer, a low-resolution base layer, smart packaging, and very low-latency protocols, Tiled VR streaming can offer extremely low motion-to-photon delay, even when streaming from existing CDNs. The paper will conclude with trade-offs between quality and bitrate, with tiling occurring in a 4K or 8K source to produce, respectively, an HD and UHD experience on HMDs, based on field trials and realistic use cases. The paper presentation will be backed by a demonstration of a VR production in 8K using VR Tiling technology and comparing the legacy approach with tiling 4K and 8K productions.

Speakers: Thierry Fautier

5:30 PM - 6:00 PM   **Annual Membership Meeting - Salon 1**
Salon 1

Join us as Executive Director Barbara Lange and President Matthew Goldman will provide a state of your Society. In our next century, there is much to report on the Society's current activities as well as what is in store. Come learn what SMPTE is up to and feel free to ask questions! This event is free and open to all - non-members are welcome!

6:00 PM - 8:00 PM   **Centennial Hall Oktoberfest Reception**
Centennial Exhibit Hall

Join us for the second annual SMPTE Oktoberfest reception on Tuesday, 24 October, in the Centennial Exhibit Hall, from 6-8pm. Oktoberfest provides you with the opportunity to meet with Centennial Hall exhibitors, visit the Broadcast Beat SMPTE Live! Studio, and view the mix and mingle. Complete with imported beer and German-themed nibbles, the Oktoberfest will surely be a time to remember. All SMPTE 2017 attendees are welcome! Dirndls and Lederhosen are optional.

Wednesday, October 25, 2017

7:30 AM - 8:30 AM   **Wednesday Morning Coffee - Ray Dolby Ballroom Terrace**

Workflow Systems Part 1 - Salon 1

Workflow Systems - Part 1.....N/A
Salon 1
Chair: Kylee Peña (Bling Digital & Blue Collar Post Collective, USA)
Date: Wednesday, October 25
Time: 8:30 AM - 10:00 AM

Staying Grounded and Looking Ahead in Workflow Management
In the management of workflow, we're always thinking about two things: what's working today and what will still work tomorrow? As the potential future of these systems continues to become a challenging reality teams must deal with today, investigating both sides of this prevents us from getting stuck in an expensive day dream or frustrating dead end. Separating the long-standing terrestrial side of workflow systems from its growing cloud component, this session will provide a real world outlook on IMF, IOA, and how flexibility and agility will be key to staying grounded in the complex future of workflow systems.

UHD, Bigger, Better, Faster Part 1 - Salon 2

UHD, Bigger, Better, Faster - About Acquisition and Processing - Part 1.....N/A
Salon 2
Chair: Hans Hoffmann (European Broadcasting Union, European Union)
Date: Wednesday, October 25
Time: 8:30 AM - 10:00 AM

About Acquisition and Processing
This session highlight the most recent technical developments in Acquisition, processing and presentation to make UHDTV a real immersive experience. Fundamentally the session with dive into the full application of all parameters of the ITU-R BT2020 standards with higher resolution, increased bit-depth and dynamic range, extended colour space and high frame rates and will reveal the challenges in image capture and processing.

Cinema Processing & Projection Technology-Room TCL

Cinema Processing and Projection Technology.....N/A
TCL Chinese Theatres

Chair: Siegfried Foessel (Fraunhofer IIS, Germany**)**
Date: Wednesday, October 25
Time: 8:30 AM - 10:AM

The Future is Bright: Enjoy the Best Cinema you have Ever Seen
Cinema is the place for highest immersive audiovisual experience. To achieve this goal in the digital age many new technologies have been developed in the last fifteen years. But the consumer industry is breathing down in the neck. Good differentiations are necessary and this can be achieved only by implementing environmental conditions and using extra technologies not available in the living room. Today it is possible to simulate a new cinema in virtual reality before building it, frame rates on the screen can be adapted to the content and the contrast can shoot you to a different world. If you want to see how this is possible you should join this session?

Workflow Systems Part 1 - Salon 1

8:30 AM - 9:00 AM   **Applying an Agile Approach to Next Generation Media Management.....547**
Salon 1

In the words of Alex Dunlap (GM Cloud Front, AWS) the industry is "…going to get out of the data centre business... …going to get out of running infrastructure... …going to focus on what makes my [sic] business special." This sentiment is clearly echoed across the industry with big players such as FOX (Networks Engineering & Operations) stating that "everything will be in the cloud by 2019". However, to simply adapt existing products or infrastructure to "sort of" work in the cloud or to move existing applications to the cloud-based platform isn´t enough. To react to changing business models and optimize solutions for the cloud environment, both vendors and buyers need to rethink how media management is deployed and used. They need to be able to adapt their workflows in an agile way and infrastructures such as media asset management systems need to accommodate new requirements quickly and cost effectively. Big, complex and monolithic systems, along with the typical vendor lock-in, do not provide enough flexibility in that respect.In this paper we will look at how we can take inspiration from other industry sectors and disciplines to make the most of the adaptability and scalability of a virtualized infrastructure. In doing so we will re-orientate the building blocks of media workflows from heavy, workflow-wide data stratum to standardised, dynamic, scalable pillars of functionality and identify five principles of technology and software architecture which enable building distributed, flexible and scalable systems: - Micro-service design - Event driven architecture - All-API paradigm - Distributed object storage - KPI reporting to enable usage based billing Finally we examine how complimenting agile product development and deployment with agile thinking in system planning, project management and maintenance will unleash the potential to disrupt static processes and workflows. Key takeaways: - Five principles of technology and software architecture that enable distributed, flexible and cloud deployments - Lessons learned from other industries - where are the "quick wins" in moving to a virtualized infrastructure - How applying Agile concepts in the way we design, develop, plan, implement and maintain solutions can help us respond and adapt to the evolving challenges of cross-platform monetization.

Speakers: Ben Davenport,
Christian Siegert

UHD, Bigger, Better, Faster Part 1 - Salon 2

8:30 AM - 9:00 AM   **Implementation of Closed Captioning System for Terrestrial UHD based on ATSC 3.0.....658**
Salon 2

In South Korea, the terrestrial UHD broadcasting based on the ATSC 3.0 standard is aired officially from the end of May 2017. To provide closed captions for the UHD programs, we developed the ATSC 3.0 closed captioning system. The closed captions in the ATSC 3.0 standard are based on IMSC1 (Internet Media Subtitles and Captions 1.0) which is mainly used in the online video streaming industry, while the captions in the previous ATSC 1.0 standard are based on CEA-708 (Consumer Electronics Association 708). The UHD programs broadcasted on the UHD TV networks are the ones simulcasted on the HD TV networks, that is, the HD programs and the UHD programs are the same except the video quality. Accordingly, we reuse the captions for the HD programs produced by the live steganography for the UHD programs since the contents of the captions for the HD and UHD programs are the same. Our system consists of two main parts: caption format converter and caption data generator. The captions for HD programs delivered through the RS-232 are converted into the W3C TTML (Timed Text Markup Language) captions by the caption format converter. It delivers the resulting captions to the caption data generator through the UDP port. The caption data generator creates the complete IMSC1 caption and generates the caption data as a form of the ATSC 3.0 service. To make timely aligned captions with the video, the system interoperates with the UHD video encoder by receiving timing information from it. We implemented the closed captioning system, both for the MMT (MPEG Media Transport) and the ROUTE (Real-time Object Delivery over Unidirectional Transport), which

are transport protocols in the ATSC 3.0 standard, and verified it by testing on commercial ATSC 3.0 UHD TV receivers. This is the world's first development of the IMSC1 closed captioning system on the terrestrial TV.

Speakers: YunHyoung Kim

Cinema Processing & Projection Technology-Room TCL

8:30 AM - 9:00 AM

VR Theater, a Virtual Reality based Multi-Screen Movie Theater Simulator for Verifying 754
TCL Chinese Theatres

VR Theater, a Virtual Reality based Multi-Screen Movie Theater Simulator for Verifying Multi-Screen Content and Environment

The needs for a more immersive viewing experience in modern cinemas have given birth to novel movie theater technologies such as Barco's Escape and CJ-CGV's ScreenX; which utilize the side walls of a movie theater to project peripheral content to auxiliary the main content projected on the center screen. However, because theaters that support such application are each different in structure, producers need to modify the content for each theater which is a cumbersome task. In addition, the recent advances in Virtual Reality technology allow users to create unexplored solutions in the area of games, industry, and simulation of spaces. VR based theater simulators are already in the market but restrict users from modifying certain aspects of the cinema and are limited to ordinary theaters. This paper introduces VR Theater, a VR based multi-screen movie theater simulator that enables researchers and multi-screen producers to provide a testing platform for multi-screen content ! and environment with arbitrary settings. VR theater can simulate any movie theater with different structures in the world as long as the correct dimensions of the cinema are provided, play custom main content and wing content for the side walls, select the view of a certain seat in a movie theater, mask out certain areas of the wing content to prevent projection light from entering moviegoers eyes and correct the size of the content being projected in the simulated VR movie theater. In addition, auxiliary functions that allow rearrangement of seat positions, lighting, wing projector position and side wall texture material editing is provided. We predict that multi-screen producers and researchers will be able to make use of this application when producing and researching for multi-screen content.

Speakers: Kyunghan Lee,
Cho Sungmin

Workflow Systems Part 1 - Salon 1

9:00 AM - 9:30 AM

IMF End-to-End Workflows in Media Asset Management Systems.....645
Salon 1

This paper proposes the guidelines that must follow a new generation Media Asset Management systems to offer an IMF end-to-end workflow. In the presentation we will go deep in the challenges of processing IMF packages for the different scenarios (Masters, Localized, Editorial Versions), how to address them (CPL processing) and take advantage of the IMF spec to build an Content Library to provide Efficient and Flexible delivery to multiple destinations by re-creating new IMF packages. IMF is becoming a reality for Content distribution due to the benefits in costs reduction and straightforward processing: generation of a IMF Packages for masters, localized versions and editorial versions to manage and optimize the media exchanged. For this reason, Media Asset Management systems need to be able to offer an end-to-end IMF workflow that takes advantage of the IMF specs without overloading the processes due to internal conversions / limitations in the content management structu! re. In addition, new versions generation needs to be done efficiently in a way that no media is replicated: masters are referenced from the different versions in a composition that includes the additional elements needed for new material: i.e. Localized version in French with text insertions and Audio and subtitles in French, other Commercial Version with other cuts, Different technical version, etc. And finally, content delivery needs to fit perfectly into an IMF specification so that the package that is delivered takes all the advantages of this 'Logical Versions' offering a flexible mechanism to select what components to deliver (video, audio subtitles), in which order and with the transformations to be done. To summarize, new Media Asset Management Systems need to be able to support: - IMF Import, processing the IMF and creating assets that can be physical or virtual, preserving the IMF Composition playlist and without media duplication - Content Enrichment, by creating! new versions establishing logical references to the Master and taking advantage of the logical references to the media from the Master(s) - IMF Delivery, not limited to the original IMF received packages but being able to generate new ones with any compatible combination of the components for a specific Title: Video (SDR, HRD, different aspect ratios), Audio Languages, Subtitles.

Speakers: Julián Fernández-Campón

UHD, Bigger, Better, Faster Part 1 - Salon 2

9:00 AM - 9:30 AM

Beyond 4K: Can we actually tell stories in motion pictures and TV in 8K?.....577
Salon 2

Even though the full scale implementation of 4K (Ultra HD) is not yet achieved, demos showcasing 8K (Super Hi-Vision) are already introduced at major industry conferences and

trade shows. While it is part of the strategic plan of some public and private parties, and already standardised (Rec. ITU-R BT.2020, SMPTE ST 2036-1, ARIB STD-B56) the question of the value of 8K (or, more precisely, 7680p) as a storytelling tool deserves further consideration. In this paper, we analyze the relative worth of achieving such a resolution through the lens (pardon the pun) of the cinematic language, as it has been defined over the last 120 years. From a technical perspective, the resolving capacity of the human eye, proxemics (the science of interpersonal distances) and dynamic resolution (motion) are applied to cinematic conventions to determine whether this increase in spatial resolution yields an improvement in viewer experience. The paper demonstrates that there are very few cinematic shots which actually benefit from 8K. In most cases, framing conventions would need to be drastically widened, and motion reduced to almost nothing, defeating the purpose of motion pictures. In the opinion of the writer, progress in sensor technology, bandwidth and compression would be more effectively leveraged in the delivery of "better" pixels, instead of "more" pixels. The author describes several avenues that could be explored using this philosophy, namely the use of ultra high frame rates (240Hz), lesser compression, higher dynamic range and more immersive media.

Speakers: Pierre Routhier

Cinema Processing & Projection Technology-Room TCL

9:00 AM - 9:30 AM   **Variable Frame Rate Display For Cinematic Presentations.....745**
TCL Chinese Theatres

While motion pictures have traditionally been captured and presented at a frame rate of 24 frames per second, recent advancements have enabled the capture and presentation at higher frame rates of 48, 60, and even 120 frames per second. Capture and presentation at higher frame rates provide improvements in clarity and motion rendition, but come at the cost of increased storage space, processing, and workload for the entire motion picture. Motion picture creators want the capability to reduce the motion judder, and blur associated with capturing moving images while still maintaining the cinematic feel of their creations. By introducing a method where the projector can vary the frame rate during playback, the scenes that most benefit from higher frame rates can be captured and presented at that rate, while the scenes that do not benefit from higher frame rates can be captured and presented at lower frame rates. The engineers working with DLP Cinema at Texas Instruments have come up with a method to allow changes to the displayed frame rate to be communicated effectively through the entire playback chain during a presentation with no visible artifacts on screen before, during, or after the transition. This Variable Frame Rate (VFR) capability enabled by the latest DLP Cinema systems is further described in this paper.

Speakers: Tim Ryan

Workflow Systems Part 1 - Salon 1

9:30 AM - 10:00 AM   **Leveraging Hybrid Cloud Workflows in Media and Entertainment.....682**
Salon 1

Production, broadcast and distribution companies are increasingly collecting high-resolution content from every stage of the workflow. Studios are struggling to find efficient infrastructure solutions to create and maintain comprehensive digital libraries that will support a global organization. By leveraging hybrid cloud storage and processing resources to make the workflow more efficient, M&E companies can leverage the C4 standard to create a video platform with indelible metadata. This allows M&E to easily integrate the cloud to process, collaborate and archive content and easily insert that content into a modular workflow process. The secret is to create a hybrid cloud workflow that utilizes both on-premise and cloud infrastructure resources. By leveraging object storage to enable this new way to look at workflows, studios can strategically plan out the materials and processes they need to prioritize. This will in turn enable studios to increase ROI and reduce TCO in a private and secure way. This session will look at use cases of how media and entertainment companies are using the cloud to cost-effectively store all captured footage and accelerate its production workflow. This session will explore infrastructure technologies that are effectively being used to improve productivity and lower TCO for 2K, 4K, 6K, HFR and UHD workflows.

Speakers: Joan Wrabetz

UHD, Bigger, Better, Faster Part 1 - Salon 2

9:30 AM - 10:00 AM   **Access Services for UHDTV: an Initial Investigation of W3C TTML2 Subtitles (Closed-Captions).....495**

Ultra High Definition Television and High Dynamic Range has been a focus of research for the past few years, however only now is work starting on the provision of access services for such content. These services are used by a large minority of the audience (up to 25%) and legislation mandates their inclusion in many territories.The authors present work undertaken for the W3C Timed Text Markup Language group to create a subtitle transform for use with HLG high dynamic range video. Further, they present test results investigating the perceived brightness of subtitles using the TTML conversions when displayed over different HDR video content, and whether the requirements for subtitles with HDR video differ from those for subtitles with SDR video.

Speakers: Simon Thompson

Cinema Processing & Projection Technology-Room TCL

9:30 AM - 10:00 AM   **Projector Contrast Performance in a Cinema Environment.....715**
TCL Chinese Theatres

A new breed of premium cinema formats has emerged recently called Premium Large
Format, or PLF, to enhance the consumer cinema experience. Dolby Laboratories' PLF,
called Dolby Vision®, features projectors with dramatically improved dynamic range. In this
paper we explore the impact of room and optics-related factors and assess how these impact
the perceived contrast ratio of the images produced by the projector.

Speakers: Martin Richards

10:00 AM - 10:30 AM   **Wednesday Morning Coffee Break - Dolby and Centennial Exhibit Halls**

Workflow Systems Part 2 - Salon 1

Workflow Systems - Part 2.....N/A
Salon 1

Chair: Al Kovalick (Media Systems Consulting, USA)
Date: Wednesday, October 25
Time: 10:30 AM - 12:00 PM

Above the Clouds - Applications for Media

In the management of workflow, we're always thinking about two things: what's
working today and what will still work tomorrow? As the potential future of these
systems continues to become a challenging reality teams must deal with today,
investigating both sides of this prevents us from getting stuck in an expensive day
dream or frustrating dead end. Separating the long-standing terrestrial side of
workflow systems from its growing cloud component, this session will provide a real
world outlook on IMF, IOA, and how flexibility and agility will be key to staying
grounded in the complex future of workflow systems.

UHD, Bigger, Better, Faster Part 2 - Salon 2

UHD, Bigger, Better, Faster - About Acquisition and Processing - Part 2.....N/A
Salon 2

Chair: Hans Hoffmann (European Broadcasting Union, European Union)
Date: Wednesday, October 25
Time: 10:30 AM - 12:00 PM

About Acquisition and Processing

This session highlight the most recent technical developments in Acquisition,
processing and presentation to make UHDTV a real immersive experience.
Fundamentally the session with dive into the full application of all parameters of the
ITU-R BT2020 standards with higher resolution, increased bit-depth and dynamic
range, extended colour space and high frame rates and will reveal the challenges in
image capture and processing.

10:30 AM - 5:00 PM   **Exhibits Open at 10:30 AM - Ray Dolby Exhibit Hall and Centennial Exhibit Hall**

Workflow Systems Part 2 - Salon 1

10:30 AM - 11:00 AM   **Cloud Transition Patterns for Media Enterprise.....612**
Salon 1

Media enterprises are increasingly looking at how the cloud can be harnessed to support
operational and business agility. With these transformations they are evaluating the
implications to their business models, workflows and technology for content production.
Multiple hosting choices are available to move equipment investment from machine rooms to
centralized data centers and cloud environments. In moving the process running on bare
metal in the machine to shared resource infrastructure in data centers or cloud, multiple
choices of virtualization technologies are also present. On one hand, fast transformations are
to be achieved by lifting and shifting known applications and appliances using virtual
machines. On the other hand, use of containerized micro-services and cloud native
architectures offer promise of agility and cost efficiency. The usefulness of each option will
be presented by understanding current media production infrastructure needs and its
mapping to virtualization as hosting technologies become available. The post production
industry's deployment preferences leads to a notion of a common software platform to host
media processes across the various cloud infrastructure choices available. In hybrid
deployment models, the message bus based communication framework provides tremendous

value and flexibility in order to ease the technology transformations.

Speakers: Shailendra Mathur,
Gerald Tiu

UHD, Bigger, Better, Faster Part 2 - Salon 2

10:30 AM - 11:00 AM **Content Production Technology on Hybrid Log-Gamma.....632**
Salon 2

NHK produces a variety of contents for 8K test satellite broadcasting. Recommendation ITU-R BT.2100 was standardized only during last year and we are currently in the process of testing and verifying the hybrid log-gamma (HLG) productions accordingly. For 4K-8K satellite broadcastings, which will be launched in 2018, we plan to extend the broadcasting time for longer than that of the test broadcasting. Therefore, producing considerably more contents is necessary. Currently, our main broadcasting service is HDTV; hence, it is important to produce the 8K, 4K and HD contents effectively. To decrease the burden of content production, we developed two signal converters and plan to use them for the content production including not only conversion of the signal formats but also simultaneous production of UHDTV and HDTV. One signal converter processes the signal conversion between two high dynamic range (HDR) transfer functions--HLG and Perceptual Quantization (PQ)--by means of Recommendation ITU-R BT.2100. In addition, we installed a semi-automatic conversion system between HDR and standard dynamic range (SDR) to adjust a few video parameters; gain, black offset, and compression level of high luminance. It allows video engineers to compare HDR with SDR, which is converted from HDR side by side at the simultaneous production. The down-converter from UHDTV to HDTV, however, supports conversion of color gamut and dynamic range simultaneously. To reduce the deterioration of the color gradation in the conversion from Rec. 2020 to Rec. 709, we used a method based on the color perceptual model. In addition, it features a function that enhances the edge of the images based on specific spatial frequency after the down-conversion. In this paper, we describe the use cases of HLG content production using the converters and evaluate their effectiveness. Moreover, we show the high quality content production using the specific parameters for simultaneous production of UHDTV and HDTV contents.

Speakers: Yuji Nagata

Workflow Systems Part 2 - Salon 1

11:00 AM - 11:30 AM **MOVING TO THE CLOUD: Current Risks & Rewards.....688**
Salon 1

MOVING TO THE CLOUD: Current Risks & Rewards - An analysis of the current state of the art for cloud-based production pipelines. Cloud based production pipelines are a new reality. Are the benefits of this new wave of creative and technical democratization fact or myth? What is the state of the art in 2017, the primary technical and operational challenges and the primary benefits? How does the CTO, business manager and production manager navigate this complex new environment? What are the current operational / business upsides? Where are the hidden risks? This paper is an in depth analysis, (application / implementation case study) of the current state of the art for technical and production workflows within a cloud based pipeline. It examines three real world case studies to compare and contrast technical and production workflows, before and after moving a production into the cloud. This application / implementation case study examines live action and animation media production environments through long form live action, short form animation and short form VR / games. It reports on the primary technical and production workflow challenges of moving to the cloud, summarizes the current state of the art and provides a road map for individuals and businesses considering moving to the cloud. How do individuals and businesses prepare to negotiates for best solutions in this new eco-system?The top three information take-aways for the audience are:1. Succinct technical / production report on the current most common solutions for cloud based application streaming; 2. A list of the current production workflow challenges in a cloud based collaboration environment with solution examples; 3. A list of the primary concerns businesses and individuals should focus on as they consider moving production pipeline into the cloud: i. risks and rewards ii. mitigating against data loss and production workflow impacts, iii. Discussion of pricing, streaming controls and data synching

Speakers: Corban Gossett,
Julie McDonald,
Mac Moore

UHD, Bigger, Better, Faster Part 2 - Salon 2

11:00 AM - 11:30 AM **Choosing Encoding Parameters for High-Dynamic Range Streaming.....593**

High-Dynamic Range (HDR) could be a very powerful storytelling tool for cinema and television. Yet, HDR's newness also means that we don't have consensus on how best to prepare and distribute HDR content to consumers. This paper will provide data and analysis on the impact of various HDR encoding options on video quality and bitrate. Specifically, this paper will examine permutations of PQ, HLG, Y'Cb'Cr', ICTCP, encoded resolution, and bitrate using open-source encoders such as x265. Video quality for each permutation will be measured using publicly-available non-proprietary objective video quality metrics. The key takeaway will be unbiased data and analysis for video quality and compression efficiency that can be used when designing HDR streaming services.Background: Today, we have two

different ways of mapping light to HDR code values: Perceptual Quantizer (PQ) and Hybrid-Log Gamma (HLG). We also have the option of representing color as either Y'Cb'Cr' or the newer alternative ICTCP. For HDR adaptive bitrate streaming, we need to choose which compression levels and encoding resolutions to use when we create adaptation sets; but we don't yet have a complete understanding of how resolution and compression could interact to alter the highlights and deep darks that make HDR so visually potent. When viewed altogether, the many permutations of HDR encoding can make designing an HDR streaming service too complicated and uncertain. We need a simpler way to make the best choices.

Speakers: Sean McCarthy

Workflow Systems Part 2 - Salon 1

11:30 AM - 12:00 PM

An Internet of Things Architecture for Cloud-fit Professional Media Workflow.....525
Salon 1

Flexibility, agility and scale are key benefits of moving media production infrastructure to the cloud and/or commodity data centre platforms, enabling content providers to respond to changing consumer habits. This includes new formats and new propositions, such as personalised immersive social television. Can a "lift and shift" approach - deploying existing production tools designed for enterprise computing environments into the cloud - deliver these benefits? This paper presents an alternative architecture that is designed to be cloud-fit, using a software-only approach for deploying dynamic software infrastructure.The paper starts by outlining both the benefits and constraints of cloud-based systems, including issues related to virtualised systems being inherently non-real time. An architecture that overcomes these limitations is then presented, along with an approach for dealing with security and scaling. This consists of a combination of mainly IT tool sets (e.g. monitoring tools, orchestration engines, cloud APIs, automated software deployment) with media-specialist software components. A key aspect of the architecture is to use media transport mechanisms that can take advantage of the modern data centre platform in a secure and scalable way. The media and entertainment industry is now just one of many industry sectors that streams data through clusters of commodity computers. The paper presents a big-data approach to stream-based processing designed to make use of today's multi-core architectures, something that the SMPTE ST 2110 set of standards is not well placed to do. An instance of this architecture has been created using an open source IoT wiring tool. This is being trialed as part of BBC Northern Ireland's IP proof-of-concept activity, working jointly with Streampunk Media and Cinegy through AMWA Labs. The lab environment has enabled the testing and measurement of aspects of this approach, including gesture-based control (e.g. via smartphone/tablet), HTTPS media transport, fast networking with consumer devices and virtual infrastructure replacing traditional hardware solutions - including a virtual video mixer. Results from the lab will be presented, along with a description and pointer to the open source tools used to produce the results, further analysis and next steps.

Speakers: Richard Cartwright

UHD, Bigger, Better, Faster Part 2 - Salon 2

11:30 AM - 12:00 PM

An 8K Full-resolution 60-Hz/120-Hz Multi-Format Portable Camera System.....510
Salon 2

NHK is accelerating development of 'full-featured' 8K (RGB 4:4:4, 12-bit, 120-Hz, high dynamic range and wide color gamut) broadcasting equipment. We have developed a 60-Hz/120-Hz multi-format portable single-chip 8K camera system that can acquire both 60-Hz full-resolution and 120-Hz inter-line scan 8K videos using a 133-Megapixel CMOS image sensor. In the 60-Hz operation, all lines of the sensor are read progressively and a full-resolution 8K image can be captured. When in the 120-Hz operation, even or odd lines in 8K video domain are read at every 1/120 second alternatively by inter-line scanning, and the line interpolation is performed to configure the 8K image. The skipped lines in an inter-line scanned frame are interpolated with local motion detection. In the areas with motion, the missing pixels are interpolated by their upper and lower side pixels in the current frame. In the other areas without motion, on the other hand, the missing pixels are mixed in the arbitrary ratio of the current frame and the prior frame to maintain the spatial resolution and reduce random noise. The local motion can be detected by the frame difference between consecutive frames. We performed imaging experiments on interpolated 8K 120-Hz video signal and confirmed the inter-line scan and the line interpolation improved motion blur in vertical direction where resolution decreases to half due to the inter-line scanning. Moreover, we also confirmed the modulation transfer function in the still area is the same as that in the 60-Hz operation, and the signal-to-noise ratio of 120-Hz inter-line videos is the same as the 60-Hz operation at the same sensitivity setting. The weight of the camera head is 6.3 kg that is less than one-seventh that of the conventional three-chip full-resolution 8K camera. The optical format is compatible with 35-mm full-frame lenses. Signals between the camera head and the camera control unit (CCU) can be connected by a hybrid optical camera cable compliant with the SMPTE 311M standard. A 100-Gbps uncompressed signal from the sensor is transmitted over the camera cable using a CFP4 optical transceiver. The size of the CCU is 3U in a 19-inch rack, which is considerably smaller than that of the conventional three-chip full-resolution 8K cameras. The CCU processes the 100-Gbps signal in real-time and supports high dynamic range and wide color gamut. The 8K signal interface from the CCU is compliant with ITU-R BT. 2077 and SMPTE ST 2036-4.

Speakers: Tomohiro Nakamura

Lunch on Your Own

12:00 PM - 1:30 PM   **Lunch on Your Own**

Innovating People - Salon 1

Innovating People: Managing, Mentoring and Change.....N/A
Salon 1

Chairs: John McCoskey (Eagle Hill Consulting & SMPTE, USA), Yvonne Thomas (Arvato
Systems, Germany)
Date: Wednesday, October 25
Time: 1:30 PM - 3:00 PM

Managing, Mentoring and Change

People are the lifeblood of every media and technology organization, but we often
overlook the importance of understanding, care, feeding, and growth of our most
important resource. Not only is adapting our management to welcome new and
different generations of entertainment engineers vital to the future of organizations
like SMPTE, it's key to future innovations in motion picture and television
engineering. It is clear that groups of people with varying backgrounds and
perspectives are better for business and lead to more successful projects. It's also
no secret that technology-oriented organizations and industries remain sparsely
populated by women and people of color. We will explore paths to welcome all kinds
of people into an inclusive and exciting engineering field through rethinking our
management, re-calibrating programs meant to attract diverse people, formalizing
change management, and reconsidering how mentorship is really a two-way-street
across generations.

Is Compression Development at the End? Pt1-Salon 2

Is Compression Development at the End? - Part 1 -.....N/A
Salon 2

Chairs: Marc Zorn (USA)
Date: Wednesday, October 25
Time: 1:30 PM - 3:00 PM

How to Optimize the Video Quality while Compressing

Today's video compression algorithms are very efficient. However increasing
resolution and restricted bandwidth results always in limited quality at the consumer
side. In this session several techniques will be presented to improve the quality
based on perceptual measurements, by adaptation of the compression to the
content or by using machine learning technologies.

Innovating People - Salon 1

1:30 PM - 2:00 PM   **Mentoring & Reverse-Mentoring: What Baby Boomer & Millennial Tech Professionals
Can Teach Ea Other.....N.A**
Salon 1

In the third of a series of sessions addressing the future of SMPTE and the challenges of
broadening the membership to include women, minorities and millennials. One of the
common themes from the session in 2015, Thought-Provoking Ideas for Increasing Diversity
in Entertainment Engineering as well as the session in 2016, Re-Inventing Entertainment
Engineering: Merging the Experience of Today with Millennials' Vision for Tomorrow, was the
impact and importance of mentoring of new entrants to the world of media technology and
operations. The 2017 session will address mentoring in its many forms. There are informal
mentoring relationships which occur organically as well as formal mentoring programs, such
as the HPA YEP (Young Entertainment Professionals). Indeed there is a form of 'reverse
mentoring' where there is value for an established professional gaining new insights and
information from their younger mentees. Mentoring can be valuable to established
professionals to enable their growth and success. We propose a three part session: Part 1
will be an overview of mentoring, what is a mentoring relationship, and how to establish a
mentoring relationship.Part 2 will be a discussion of the experience of mentors and mentees
and the benefits gained through mentoring.Part 3 will be a panel discussion of pairs of
mentors/mentees.

Speakers: Leon Silverman

Session Chair: Loren Nielsen

Panelists: Bill Bennett,
Kari Grubin,
Sara Kram,
Megan Stacey

Is Compression Development at the End? Pt1-Salon 2

1:30 PM - 2:00 PM **VMAF Reproducibility:Validating a Perceptual Practical Quality Metric for 4K Video**
Salon 2.....N/A

Measuring video quality with standard metrics ensures that operators can deliver to consumers the desired quality of experience (QoE) at an optimal cost. Such metrics also allow CODEC engineers to optimize the performance of their encoding algorithms. This paper briefly surveys existing video quality metrics and then presents results of the new Video Multi-Method Assessment Fusion (VMAF) metric proposed by Netflix. The author and colleagues used VMAF to measure the quality of a 4K dataset encoded with the RealMedia video CODEC at a range of bitrates. They also gathered subjective quality assessments from a group of viewers for the same dataset. The paper presents findings of correlation between subjective and objective results.

Speakers: Reza Rassool

Innovating People - Salon 1

2:00 PM - 2:30 PM **Why Diversity Programs Fail — and How to Fix Them.....767**
Salon 1

In recent years there has been a rise in diversity initiatives throughout our industry in response to mounting criticism. While college programs have been found to represent the general population well in terms of diversity, that drops off sharply after graduation, and our industry becomes largely homogenous in top-tier positions.Many initiatives are struggling to make a meaningful impact, especially when it comes to changing the face of our industry's above-the-line professionals. This is because from entry-level through the development of top talent, the established system favors a narrow range of individuals who have fewer barriers to opportunity. This established system can easily be changed without major disruption. Having studied the efforts and impact of current programs, it is apparent that many tend to approach the issue backwards instead of looking forward to create a bright, inclusive future. Through case studies and the application of research and theory, we will present analysis of current trends in diversity programs such as those offered by networks and studios for minority writers and directors. We'll offer practical adjustments, considerations and solutions to significantly improve the effectiveness of investments in diversity by companies and organizations across the film and television industry.Those reading the paper or attending the session will have tangible, actionable takeaways they can implement within their organization right away. Rather than scold, this session is meant to educate and lead decision makers and influencers toward more effective uses of time and money spent on diversity, shifting the goal toward inclusiveness.

Speakers: Kylee Peña,
Meaghan Wilbur

Is Compression Development at the End? Pt1-Salon 2

2:00 PM - 2:30 PM **QBR Metadata to Improve Streaming Efficiency and Quality.....725**
Salon 2

QBR - Quality Bitrate Streaming - improves the efficiency of adaptive bitrate video on demand delivery by providing additional metadata describing the visual complexity and encoding quality of each media segment at each data rate. This enables a compatible player to make better adaptation decisions about when to switch between different data rate renditions.In addition to factors such as the state of the local buffer and previous data transfer rates, the heuristics employed can now include information about the relative visual complexity and encoding fidelity of future segments at different data rates. The media player can use this to plan and optimise media requests. Segments with simple scenes that do not benefit from encoding at higher data rates can be replaced with encodings at a lower data rate.The result is a reduction in the volume of data delivered by up to 35% without reducing perceived quality. This efficiency gain can optionally be used to deliver higher data rate segments for more complex scenes, increasing perceived quality where it matters most, while still reducing delivery costs.Effectively, this brings the benefits of variable bitrate encoding to the multi-bitrate schemes that are widely used for adaptive bitrate streaming.The key to this approach is the provision of information to characterise each video segment at each encoded data rate. This data can be produced by video encoders or be extracted from rapid analysis of encoded segments.Formalising the semantics and syntax of this metadata allows interoperability across the ecosystem.The system is backwards compatible with existing compression schemes, including H.264/AVC and H.265/HEVC, and current HLS, HDS, Smooth Streaming and MPEG-DASH formats. Integrations are already available with popular encoders and players to provide plug-and-play compatibility, enabling service providers and media distributors to benefit from QBR.This paper presents the benefits of the approach, provides examples of the results that can be achieved, and discusses the opportunities for standardisation of the metadata, while enabling differentiation in implementation for its generation and use.

Speakers: William Cooper,
Kumar Subramanian

Innovating People - Salon 1

| 2:30 PM - 3:00 PM | **A Formal Approach to Change Management for Dynamic Technology-driven Media Organizations.....483** |
| | **Salon 1** |

Top 3 informational takeaways for the audience:1. Effective and efficient business transformation in the dynamic technology-driven environment of media companies requires a formal approach to change management 2. People and organization are the foundation of the change ecosystem, and are often overlooked as efforts are focused on technological elements 3. Formal frameworks, tools and techniques for change management are available and can be effectively applied to technology-driven media organizations and projectsWhat type of paper is proposed: Tutorial / Case studiesAbstract:Media organizations are experiencing a time of unprecedented and disruptive technological change, offering tremendous opportunities for new products, services, efficiency, and agility. However, dramatic change also causes people and organizational issues that are often overlooked, delayed and dealt with as secondary efforts. When change is introduced into an organization, it can have significant and varied impacts to the organization's business performance. The goal of formal change management is to prepare stakeholders for the change while minimizing any negative impacts to the business. Change management emphasizes the "people side" of change and targets leadership and stakeholders within all levels of an organization. When done well, people feel engaged in the change process and work collectively towards a common objective, realizing benefits and delivering results. Change management includes activities encompassing stakeholder analysis, communications, and training.Structured processes and tools can be used to manage the impact and help achieve the outcome of technology-driven organizational change. A formal methodology for change management includes the following four stages: Assess and Understand Change, Plan for Change, Implement Change, and Evaluate Change. These stages can be addressed as a linear change management process, or components of each phase may occur throughout the change effort using an iterative, agile approach.This paper will detail the formal change management approach and will offer specific examples tied to technology-driven changes undertaken by media and technology organizations.

Speakers: John McCoskey

Is Compression Development at the End? Pt1-Salon 2

| 2:30 PM - 3:00 PM | **Non-iterative Content-adaptive Distributed Encoding through ML Techniques.....707** |
| | **Salon 2** |

Distributed encoding is desired in on-demand content preparation workflows in the cloud to reduce turn-around times. While some knowledge of content properties immediately preceding and succeeding the content getting encoded in a particular instance is useful, conventional method of having the entire analysis for a title does not add significant value. Based on this, title, segment, and even frame adaptive bit allocation methods, as opposed to using a fixed ladder of content-independent bit-rates for adaptive bit-rate streaming (ABR), have been proposed to achieve average savings in storage and delivery. Many of these methods tend to be iterative in nature and consume significant additional compute resources than the conventional 2-pass Variable bit-rate (VBR) encoders. With live use-cases attempting to use a set of distributed encoders to achieve higher bit-rate savings (both through use of higher compression presets and through content-adaptive bit allocation) and consistent quality, there is a need to limit the increase in computational complexity. In this paper, we propose a non-iterative codec-agnostic approach that employs machine learning techniques to perform content-adaptive encoding of a group of frames and reduce the run-time computational complexity that makes it equally suitable for live and on-demand workflows. The primary challenge is to assess the right level of bit allocation for each group of frames and for each representation in the ABR set in proportion with its spatio-temporal complexity and level of visual masking at typical viewing distances (as a function of the display height). The second challenge is to ensure that no segment exceeds a specified maximum bit-rate for that representation. Additional challenges involve ensuring consistent handling of all parts of a scene irrespective of segments having a mixture of multiple scenes and a scene spanning multiple segments that have been distributed. The proposed approach also anticipates automatic selection of the right resolution and frame-rate for a given representation within an ABR set, and content-specific encoding parameters to maximize the bit savings and/or visual quality. Test results are presented over a wide range of content types such as titles with film grain, animation, episodic content, sports, and reality content, comparing the performance of the proposed approach against 2-pass VBR methods. Initial results indicate 30% average bit savings over conventional 2-pass VBR me

Speakers: Sriram Sethuraman

| 3:00 PM - 3:30 PM | **Wednesday Afternoon Coffee Break - Ray Dolby Exhibit Hall and Centennial Exhibit Hall** |

Is Compression Development at the End? Pt2-Salon 2

| | **Is Compression Development at the End? - Part 2….N/A** |
| | **Salon 2** |

Chairs: Siegfried Foessel (Fraunhofer IIS, Germany)
Date: Wednesday, October 25
Time: 3:30 PM - 5:00 PM

New Compression Technologies and its Applications

Although already many video codecs exist, there is still room for new technologies. Higher video resolution up to 8k during production require specialized systems, transmission of video data over IP in the studio environment is requesting lowest latency compression in an resource efficient way and 4k and 8k video transmission to the end user everywhere always calls for more efficient codecs. In this session the newest technologies in the development and pre-production stage will be presented.

Quality and Monitoring of Images & Sound - Salon 1

Quality and Monitoring of Images and Sound.....N/A
Salon 1

Chairs: John Maizels (Entropy Enterprises, Australia)
Date: Wednesday, October 25
Time: 3:30 PM - 5:00 PM

"What gets measured gets managed!!". Of course, if you don't measure, you don't know what's underperforming or broken? But do our tools know what to look for, when we might not ourselves agree on what's good and what isn't? This is an important discussion in which we look at a way to define what quality is, and some new techniques to find out if quality is being achieved.

Is Compression Development at the End? Pt2-Salon 2

3:30 PM - 4:00 PM **8K-TICO Codec for Miniaturized and Simplified UHDTV Production System.....473**
Salon 2

We developed TICO (Tiny Codec, SMPTE RDD35:2016) codec adapted in an 8K-UHDTV. The bitrate of an 8K uncompressed stream becomes 48 Gb/s (59.94 Hz, 10 bit, 4:2:2). An interface, which consists of 16 bundled 3G-SDI, has been used in practical applications so far. However, because of its increase in cable counts, the size of equipment such as video production switcher or matrix switcher tends to be large. Thus, it is sometimes complicated for us while wiring up production systems on-site. The novel codec has an interface of 12G-SDI, where 8K-TICO works using at a compression rate of 4:1 and the 8K code stream could be transmitted with a single 12G-SDI. TICO is a well-known wavelet-based mezzanine compression technology with visually lossless video quality and very low latency, below 0.2 ms. it is also characterized by a visually lossless deterioration due to the first encoding stage and independent of the number of successive decoding/encoding steps. It is then possible to introduce it as a basic format of an 8K production system and miniaturize it. The point is that we intend to adopt TICO not only as a codec for point-to-point transmission, but also as a signal format of production systems. When the number of input and output interface becomes 1/4, the number of nodes in a matrix switcher becomes 1/16. Thus, the benefit of decreasing cable counts is exponential when building up production systems. It is estimated that the cable counts will reduce to less than 1/5 and the number of nodes in a matrix switcher to less than 1/200, as compared to that in the same production scale system based on uncompressed 3G-SDIs. We adopted 12G-SDI as an I/O interface this time because when the 8K stream is compressed to 1/4, the estimated code bitrate would become similar to that 12G-SDI could transmit. 12G-SDI is available internationally from a wide range of broadcast equipment manufacture. 8K-TICO would be fit to have an IP interface, when it becomes possible to keep interoperability between different format or on the unified standard, it may be possible to adopt it as a mainstream of the interface. In this paper, we will introduce the specifications and image quality evaluation of developed 8K-TICO codec. Then, we estimate a plan of the SDI based 8K-UHDTV production system. We also discuss what we expect of the IP interface, which has a potential to become mainstream in the future.

Speakers: Masayuki Miyazaki

Quality and Monitoring of Images & Sound - Salon 1

3:30 PM - 4:00 PM **Zen and the Art of Media in Motion: The Many Aspects of Quality in the Media Supply Chain.....795**
Salon 1

In his 1974 bestseller "Zen and the Art of Motorcycle Maintenance", author Robert M. Pirsig mused on the diverse and undefinable nature of the concept of quality. In homage to the late Mr. Pirsig we discuss how this is nowhere more true than in the modern media supply chain. The metrics used to define quality in a production environment are very different to those used to define what quality means in the broadcast facility, which are different again to those used by an OTT content provider. With this paper we intend to provide a tutorial on the meaning of quality and of the techniques used to test it over the entire media supply chain. We'll start discussing the meaning of quality and the QC processes used in production and post production. Then we'll move on to consider aspects of quality and QC in the business to

business media supply chain. Finally we will consider the meanings of quality and QC during final distribution to the consumer, and the complications caused by the diversity of delivery channels and devices that are used to view content in today's world. Along the way, we will look at aspects such as measurement of picture and sound quality, ensuring regulatory compliance, prevention of harm or offence, and the effect of quality on viewer retention. We will also speculate a little on the future of QC testing, in particular on how Artificial Intelligence and Deep Learning will allow automation of QC processes that currently can only be reliably performed by people. Those attending the presentation should expect to leave with a deeper knowledge of the diversity of quality metrics and QC process that are used throughout the media supply chain. They will also gain an understanding of how automation can streamline such process and how new technology will allow more and more QC process to be automated in the future.

Speakers: Dominic Jackson,
James Welch

Is Compression Development at the End? Pt2-Salon 2

4:00 PM - 4:30 PM   **JPEG-XS - A High Quality Mezzanine Image Codec for Video Over IP.....667**
Salon 2

More and higher quality UHD content is arriving in the production environment requesting additional bandwidths for data transmission and exchange. In parallel the infrastructure shall become more flexible by using internet based protocols with Ethernet interfaces. Adding mezzanine compression in the production workflow can reduce the necessary data transmission capacities or even enable the usage of existing infrastructure from previous HD production lines. A low complexity of a mezzanine codec with ultra-low latency by preserving highest quality is one of the biggest challenges for such a new design. Having this in mind the JPEG committee started a new work item called JPEG-XS to develop an interoperable standardized codec for video over IP. The paper presents the specific requirements for such a codec, shows the results of the call for proposals and the advances during the core experiment phase. First implementations will be expected in 2018.

Speakers: Siegfried Foessel

Quality and Monitoring of Images & Sound - Salon 1

4:00 PM - 4:30 PM   **Begin with the End in Mind: A Unified End-to-End Quality-of-Experience Monitoring.....565**
Salon 1

Begin with the End in Mind: A Unified End-to-End Quality-of-Experience Monitoring, Optimization and Management Framework; There has been an increasing consensus in the video distribution industry that the design and operation of the full video delivery chain need to be driven by end-users' quality-of-experience (QoE). In practice, however, this is an extremely difficult task, largely due to the lack of effective mechanisms to instantaneously measure or predict every viewer's QoE. Moreover, existing quality assurance methods operate independently at different points along the delivery chain, reporting partial, inopportune, and incoherent measurements. This siloed structure leads to a fragmented understanding of the resulting video as it moves through each stage of the delivery network - from the acquisition point and head-end down to the media data center, the network, and eventually the end users' viewing devices. Here we propose a new framework that uses a unified end-to-end solution to produce consistent QoE scores at all points along the delivery chain under the same evaluation criterion. This is a framework that produces a clear picture instantaneously to operation engineers, managing executives and content creators about how video QoE degrades along the chain, a framework that allows immediate issue identification, localization and resolution, a framework that enables quality and resource usage optimization of the delivery chain for each of its individual components or as a whole, and a framework that provides reliable predictive metrics for long-term strategic resource and infrastructure allocations. The main challenge in the implementation of such a framework is to create a unified QoE metric that not only accurately predicts human QoE, but also light-weight and versatile, readily plugged into multiple points in the video delivery chain as either a single-ended or double-ended measure, producing real-time QoE scores across a wide range of bitrates, video resolutions, frame rates and dynamic ranges, and combining presentation picture quality with video freezing and adaptive streaming events. We show that the SSIMPLUS metric offers the best promise to such a solution. Once such a framework and the QoE metric is deployed in a video distribution system, many benefits come naturally. We demonstrate the benefit using bandwidth optimization as an example.

Speakers: Abdul Rehman,
Zhou Wang

Is Compression Development at the End? Pt2-Salon 2

4:30 PM - 5:00 PM   **New Compression Techniques for Next-Generation Video.....695**
Salon 2

MPEG is working on requirements for a new video codec, which is expected to be completed by 2020. The future-generation codec will provide a 50 percent bitrate reduction compared with HEVC Main profile for the same perceptual quality. While this is sufficient for certain use cases, it may justify a future video coding standard for other applications that require bit rate reductions of more than 50 percent. This paper will look at the target applications for the new

video codec, such as 8K, VR in 3DoF and 6DoF, the state of IP networks, and how network elements can potentially contribute to better compression via "Network Distributed Video Coding" (NDVC). Additionally, the paper will explore how new techniques can be used to reach a factor four compression compared with HEVC by 2020 using the next-generation MPEG codec. This is possible by leveraging content-aware encoding, elastic encoding, machine learning techniques, and pre/post processing pairing that uses metadata to signal how to post process video after decoding. To conclude, the paper will compare different approaches, including HEVC vs. HEVC boosted with NDVC techniques, as well as the JVET codec vs. NDVC methods.

Speakers: Thierry Fautier

Quality and Monitoring of Images & Sound - Salon 1

4:30 PM - 5:00 PM   **Towards Scalable Automated Analysis of Digital Video Assets for Content Quality Control Applications.....735Variable Frame Rate Display.....735**
Salon 1

A significant component of typical post production workflows in current entertainment industry relies on expensive human involvement for spatio-temporal analysis of digital video assets. Hence there exists a well-befitting requirement for automating such workflows, so that human effort can be further channelized into the creative aspects of the post-production process. In this paper, we identify two such problems which video content quality inspectors frequently encounter. These are namely (a) Shot change detection, and (b) Dead or stuck pixel detection. The former involves identifying precise temporal boundaries of cinematographic content in order to analyze quality of cuts, while the latter is useful for localizing and correcting spatial anomalies that emerge during the image acquisition step due to faulty sensors. To address the aforementioned, we devise two novel data-driven approaches and demonstrate their portability, scalability and efficacy through two respective cloud computing based implementations. Our approaches show promising results on our in-house dataset of a large number of movie titles indicating their effectiveness.

Speakers: Subhabrata Bhattacharya,
Adithya Prakash

5:00 PM - 7:00 PM   **Trick-or-Treat Spooktacular Cocktail Reception - Ray Dolby Exhibit Hall.....N/A**
Ray Dolby Exhibit Hall

Eat, Drink, & Be Scary! With more than 70 exhibitors demon-strating their wicked wares in the Ray Dolby Exhibit Hall, the reception is a great time to learn what's new while enjoying a glass of your favorite potion with a hearty nibble or a light bite. All SMPTE 2017 attendees are welcome to join us on Wednesday, 25 October, from 5:00-7:00 pm . . . . . . if you dare! Spooky attire is optional but encouraged.

Thursday, October 26, 2017

7:30 AM - 8:30 AM   **Thursday Morning Coffee - Ray Dolby Ballroom Terrace**

Color and Dynamic Range Management - Room TCL

Color and Dynamic Ranage Management.....N/A
TCL Chinese Theatres
Chairs: Jaclyn Pytlarz (Dolby Laboratories, USA)
Date: Thursday, October 26
Time: 8:30 AM - 10:00 AM

With the ever expanding capabilities of cameras and displays, it becomes more involved to manage differences. In this session, we will cover various methods to manage color and dynamic range down-mapping of high-dynamic-range and wide-color-gamut imagery. We will also cover techniques to manage color and dynamic range for multi-camera production. Overall, each topic will explore color management as it relates to human perception, and will present possible solutions for our future.

New Technologies & Techniques Part 1 - Salon 1

New Technologies & Techniques Part 1 - IMF and What's Next.....N/A
Salon 1
Chairs: William Redmann (Technicolor, USA)
Date: Thursday, October 26
Time: 8:30 AM - 10:00 AM

For how content is thought about, managed, and created, in the cloud or otherwise, these are ideas, technologies, and tools that are about to change how your work

gets done: From those just graduating their fledgling year to ones that might defy standardization. This track is in two parts: Part 1 reports from the field about IMF and new workflow building blocks, while Part 2 describes amazing new tools, including a creative's AI assistant.

Audio and Metadata...Can They Get Along? - Salon 2

Audio and Metadata...Can They Get Along?.....N/A
Salon 2

Chairs: Jim DeFilippis (TMS Consulting, USA)
Date: Thursday, October 26
Time: 8:30 AM - 10:00 AM

In a world where viewers need to find, share and consume moving images and sound, producers and distributors need to provide audio metadata for the audience to enjoy the full benefit of advanced audio features (e.g. alternate language, descriptive video, home/away announcers, dialog enhancements, immersive sound). In this SMPTE session, we will address audio metadata challenges in production, distribution and consumption.

Color and Dynamic Range Management - Room TCL

8:30 AM - 9:00 AM   **Core Color Rendering Algorithms for HDR Display.....101**
TCL Chinese Theatres

As is well-known, colors as they exist in the real world must be adjusted so as to look correct and pleasing when displayed on a TV or cinema screen. In color science, the process of converting these "scene-referred" colors to "display-referred" colors is termed "rendering." The Academy's ACES system is a good example of a set of open-source color rendering algorithms. The ACES Output Transforms take floating-point linear scene-referred values and produce rendered integer code values to be sent to a display.As we transition into a world of HDR display devices, there is a need for rendering algorithms that are able to produce images adapted to the needs of various displays ranging from SDR to different levels of HDR.Although the ACES algorithms do an admirable job of this, there is always room for improvement. The authors, who have both contributed to the development of the ACES 1.0 system, would like to share the results of their latest research which takes parts of the ACES algorithms and combines them with new ideas that have some advantages.Specifically we will focus on the design and benefits of "ratio-preserving" tone-scale algorithms. These algorithms avoid hue and saturation distortions associated with conventional tonal remapping algorithms. We will also explain how a "weighted-norm" technique can be used to avoid noise build-up that was a problem with earlier hue-preserving tone-scale techniques.We will also discuss the invertibility of the algorithms we present. The ability to invert color rendering algorithms is often ignored and yet it is a very important feature for modern post-production and visual effects workflows.Although color rendering algorithms are a critical part of any successful imaging system, they are not well understood by the general SMPTE community. In our talk, we will explain the ideas behind some core rendering algorithms in a way that will be accessible to the SMPTE Technical Conference audience. We will also show image comparisons processed through various algorithms to illustrate the pros & cons of various techniques.Three takeaways for the audience: • A basic understanding of tonal rendering from scene to display • Ratio-preserving tonescale algorithms avoid hue distortions • Use of a weighted-norm technique can reduce noise build-up

Speakers: Gary Demos,
                 Douglas Walker

New Technologies & Techniques Part 1 - Salon 1

8:30 AM - 9:00 AM   **IMPlementation: IMF in Practice 196**
Salon 1

The volume of Interoperable Master Packages (IMPs) being created is rapidly growing, along with the desire to fully utilize the Interoperable Master Format (IMF) for interchange, complex versioning, and mezzanine workflows. High-end toolsets for creating IMPs have quickly evolved, enabling the industry to create IMPs that incorporate the latest asset types and feature sets of the IMF standard. However, cost-effective toolsets capable of proper playback and transcoding of these IMPs for downstream use are limited or lack the full feature set needed for wider industry adoption across the entire supply chain.

The first wave of IMPs being created and distributed have largely been simple, base IMPs that contain a single or limited number of Composition Playlists (CPLs), but that is rapidly changing as the industry seeks to fully realize the benefits of IMF for complex versioning. To achieve these benefits, better downstream tools are needed that not only support simple IMPs, but complex IMPs that utilize both base and supplemental IMPs with multiple CPLs and a multitude of essence files. Over the course of creating and servicing more than 1,000 IMPs for features and episodics in 2016 alone, and working with major worldwide content creators

and distributors on IMP creation and Quality Control (QC) across the creation-to-delivery supply chain, Deluxe has had a unique vantage point for identifying key gaps that stand in the way of widespread adoption.

This paper presents a combination of research and case study that identifies key gaps and proposes ways to close them to move toward an IMF pipeline that supports seamless creation-to-distribution workflows. Among other learnings, readers will take away from this paper: Which versions of IMF are most commonly used, how base and supplemental IMPs are being leveraged today and the challenges surrounding them, critical holes in the current IMF standards and toolsets that need to be addressed, the most common workarounds and approaches addressing those holes today, and suggested approaches for moving forward.

Speakers: Eric King

Audio and Metadata...Can They Get Along? - Salon 2

8:30 AM - 9:00 AM   **Metadata Based Audio Production for Next Generation Audio Formats.....228**
Salon 2

The next generation immersive audio formats will require changes in the audio production workflow. Monitoring the audio along with authoring and verifying of dynamic metadata will become a new challenge. New procedures for managing object based encoded content the same way as for personalization of services through the selection of alternative audio objects (such as commentator languages) needs to be established. Object based audio will give the end user the option to personalize their experience by selecting from a number of audio sources and controlling the level and maybe even the position in the mix. In object based audio, an "object" is essentially an audio stream with accompanying descriptive metadata. The metadata carries information for the playback rendering process in the final decoder/receiver. What does this all mean for the production of future audio content? A total re-think about the workflows and the audio processing equipment will be required? There will be inevitably some additions to production and distribution equipment. In the case of Immersive Audio and object based audio, all the metadata appropriate for the final codec needs to be created and must reach the final emission encoder. File based processes needs to perform this similar to stream based real-time live content production. The way of mixing and mastering will change and more auto-production procedures will be used to run NGA audio and legacy formats simultaneously the same time. Monitoring the audio programs by rendering the presentation based on metadata information will be an essential part of the new production workflows. Maintaining proper loudness conditioning will become another challenge for the metadata based NGA formats. There will some major challenges for the production side of the industry if starting Immersive Audio and object based audio (OBA) production. The presentation will describe some of the new procedures and will give ideas on intermediate steps on the way to metadata based audio production for Next Generation Audio formats.

Speakers: Peter Poers

Color and Dynamic Range Management - Room TCL

9:00 AM - 9:30 AM   **Color-matching Shots from Different Cameras having Unknown Gamma or Logarithmic Encoding Curves.....85**
TCL Chinese Theatres

Paper proposed: Research article. Takeaways: 1. In cinema and TV industry, manual adjustments by technicians are needed to ensure color consistency when combining footage from different sources. 2. We present a color stabilization method that, given two images of the same scene taken by two cameras with unknown non-linear encoding curves (logarithmic/gamma) and unknown settings, is able to correct the colors of one image making it look as if it was captured with the other camera. 3. The method is fast and the results outperform the state of the art both visually and according to several metrics. Abstract: In cinema and TV it is quite usual to have to work with footage coming from several cameras, which show noticeable color differences among them even if they are all the same model. In TV broadcasts, technicians work in camera control units so as to ensure color consistency when cutting from one camera to another. In cinema post-production, colorists need to manually color-match images coming from different sources. Aiming to help perform this task automatically, the Academy Color Encoding System (ACES) introduced a color management framework to work within the same color space and be able to use different cameras and displays; however, the ACES pipeline requires to have the cameras characterized previously, and therefore does not allow to work 'in the wild', a situation which unfortunately is very common. We present a color stabilization method that, given two images of the same scene taken by two cameras with unknown settings and unknown internal parameter values, and encoded with unknown non-linear curves (logarithmic or gamma), is able to correct the colors of one of the images making it look as if it was captured with the other camera. Our method is based on treating the in-camera color processing pipeline as a combination of a 3x3 matrix followed by a non-linearity, which allows us to model a color stabilization transformation among two shots as a linear-nonlinear function with several parameters. We find corresponding points between the two images, compute the error (color difference) over them, and determine the transformation parameters that minimize this error, all automatically without any user input. The method is fast and the results have no spurious colors or spatio-temporal artifacts of any kind. It outperforms the state of the art both visually and according to several metrics, and can handle very challenging real-life examples.

Speakers: Raquel Gil Rodriguez

New Technologies & Techniques Part 1 - Salon 1

9:00 AM - 9:30 AM

Microservices: Building Blocks to New Workflows and Virtualization?.....234
Salon 1

As the media production and broadcast industry continues to transition toward IP workflows to gain flexibility and compete with nontraditional media entities such as Google and Amazon, the term microservices comes into play. While microservices have been deployed successfully in other industries, they are relatively new to broadcast and are, therefore, prompting many questions. What are microservices and what do they offer? Are they hardware- or software-based? Are they related to a Virtual Machines (VMs), Service-Oriented Architectures (SOAs) or Containers, or are they something completely different? And where do microservices make the greatest impact? This tutorial-type paper will explain what microservices are and how they compare to VMs, Containers and SOAs, as well as how they potentially interact. It will detail where and how microservices have been deployed in other industries and where and how they make the most sense in the media production and broadcast industry. The paper will look at platforms and potential hardware, as well as software-based architecture decisions. Microservices basically break down architectures, workflows and applications into smaller, discrete components — allowing for a new style of workflow design and implementation that is vastly different and more efficient than today's monolithic approaches to software applications and programs. Rather than deploying a large application where only a subset of its possible functionality is utilized, microservices enable us to work at a lower level to tailor a processing solution that specifically, and solely, meets the particular need. Microservices allow for simplified management of code and updates, limiting the scope to their module, thus making testing of new functionality easier and upgrades faster and less prone to issues. Microservices bring a whole new level of potential collaboration to the broadcast industry. Because they can be developed autonomously, communicating through a common API, various customers and vendors can develop individual functions or services that can link together to create new applications. Microservices stand to be the building block of choice for future designs and implementation strategies, enabling valuable, component-sized functions to be mixed together into unique applications. Key audience takeaways include, 1. What are microservices? 2. Why do they matter — or what can I do with them? 3. What do they have to do with the future of the cloud and virt

Speakers: Darren Gallipeau

Audio and Metadata...Can They Get Along? - Salon 2

9:00 AM - 9:30 AM

An Open, Standards Based Framework for Audio Metadata Transport in Live Content Workflows.....1
Salon 2

While file based audio workflows have taken advantage of rich metadata in the production and distribution process, support for audio metadata in live production and distribution has historically been limited. Audio metadata and transmission formats for live workflows exist and meet basic requirements for typical channel based audio applications, however they are limited in capability and are not generally capable of supporting new emerging audio applications that require rich metadata sets to function. This includes metadata for object position, loudness, and personalization needed by new audio codecs, such as those in specified in ATSC 3.0 (AC-4 and MPEG-H).Described is a model for audio metadata transport in live workflows that will meet the requirements for current and future audio formats. The framework is standards based and essence agnostic, allowing for use with a wide variety of audio formats and applications. The format groups audio metadata into logical payloads that can be customized for specific use cases. It allows for bit efficient coding of audio metadata in short bursts to meet low latency and switching requirements in live production, but also allows for full, structured syntaxes, including XML based syntaxes, for use cases that can take advantage of them. The format is also not tied to a specific metadata standard. Current audio metadata standards are supported, but the format is open to support new audio formats as they arise, as well as private and/or non-standard metadata.The format uses SMPTE ST 336 (KLV) for the base structure of the format, and takes advantage of existing KLV transport specifications when available. These encompass current and future broadcast architectures. ST 2109 targets applications for transport in AES3 streams, for operation with existing SDI and AES3 based infrastructures. Native KLV transport using RTP over IP allows for an unconstrained metadata path in IP transport infrastructures, including those based on ST 2110.While targeted at live production and distribution, the format takes into consideration metadata paths for emission to enable a seamless "microphone to speaker" metadata path for efficient delivery of audio metadata from content creator to the end user. Interoperation with file based formats and workflows is also considered in the design.

Speakers: Kent Terry

Color and Dynamic Range Management - Room TCL

9:30 AM - 10:00 AM

Automatic, Fast and Perceptually Accurate Gamut Mapping Based on Vision Science Models.....31
TCL Chinese Theatres

Type of paper: Research article. Abstract: Gamut mapping (GM) is the generic name of the procedure that must be carried out to adapt the colors of the image content to the color

capabilities of the intended display technology. Most often it takes the form of gamut reduction, as in the case of cinema post-production when from the theatrical version in wide-gamut DCI-P3 a reduced-gamut BT.709 version must be created for TV/Bluray /streaming. But new and emerging displays have increasingly wider gamuts, so gamut extension is becoming a need as well, in order to appreciate the full color potential of new devices and improve the user experience.In film, GM is carried out manually by skilled technicians and it can be a very labour-intensive and complicated process, but it is preferred to automated methods (used in TV broadcasts, low-budget productions and display devices) that can't guarantee results of sufficient quality. Therefore, there is a pressing need to develop accurate, automatic and fast GM algorithms that can deal with imagery intended for conventional as well as emerging displays.We present a GM framework that allows to perform both gamut reduction and gamut extension. It is based on retinal and color perception models from vision science that involve a cascade of very simple linear and non-linear operations, like convolution with a fixed kernel (following lateral inhibition in the retina) and comparisons/thresholding (following cortical non-linearities that are key in color perception theories).The proposed method produces results that are perceptually faithful to the original content, free of spatio-temporal artifacts of any kind and that outperform the state-of-the-art, as validated both using psychophysical tests and objective metrics. These new algorithms for gamut extension and reduction are reliable and fast, and therefore have a great potential to be implemented in movie post-production suites, in cameras, in display devices, and in TV equipment for simultaneous UHDTV and HDTV broadcasts.

Speakers: Marcelo Bertalmio

New Technologies & Techniques Part 1 - Salon 1

9:30 AM - 10:00 AM   **Automating Digital Asset Production with SCTE Messages.....45**
Salon 1

Content production networks produce up to 70 different variants of each program asset to meet obligations to a growing number of distribution partners. An improved vocabulary for SCTE 104 and SCTE 35 messages enables in-band description and instructions for processing content segments of live streams. With this information, the production of live and on-demand digital assets can be automated to extract, format and brand assets to meet the various requirements. This paper describes the critical elements of designing and implementing systems that automate the creating the digital assets. This paper will describe the steps taken to implement and deploy a working multi-vendor workflow.1. SCTE message schema design for workflow automation. 2. Implementing automation and message insertion. 3. Implementing message extraction and processing 4. Summary of results

Speakers: Jim Duval,
Eric Openshaw

Audio and Metadata...Can They Get Along? - Salon 2

9:30 AM - 10:00 AM   **Lightweight Air-Ready Masters with AAC in MXF.....N/A**
Salon 2

The mapping of MPEG Advanced Audio Compression (AAC) into MXF was recently standardized by SMPTE as ST 381-4. AAC has been selected by PBS for their next generation file distribution to member stations, because of its fidelity, embedded metadata and the substantial reduction in file size it provides, with attendant cost savings to users.This paper looks at AAC in MXF from several perspectives: (1) the end user's view - why a lightweight, standardised air-ready master is important, (2) The Audio fidelity view - why it is important to correctly wrap AAC and preserve its metadata (3) The MXF specifics - what we did and why we created an extra Index Table document (4) Standardizing it - what's in the standard and how it relates to AVC in MXF (5) Benefits in file distribution workflows.

Speakers: Oliver Morgan

10:00 AM - 10:30 AM   **Thursday Morning Coffee Break - Dolby and Centennial Exhibit Halls**

New Technologies & Techniques Part 2 - Salon 1

New Technologies & Techniques Part 2 - Exotic New Tools.....N/A
Salon 1

Chairs: William Redmann (Technicolor, USA)
Date: Thursday, October 26
Time: 10:30 AM - 12:00 PM

For how content is thought about, managed, and created, in the cloud or otherwise, these are ideas, technologies, and tools that are about to change how your work gets done: From those just graduating their fledgling year to ones that might defy standardization. This track is in two parts: Part 1 reports from the field about IMF and new workflow building blocks, while Part 2 describes amazing new tools, including a creative's AI assistant..

Emerging Research in Visual Perception.....N/A
Salon 2

Chairs: David Long (Rochester Institute of Technology, USA)
Date: Thursday, October 26
Time: 10:30 AM - 12:00 PM

As emerging cinema equipment and computer-generated imagery tools strive to push the bounds of our vision, it is imperative that we continue to affirm practical perceptual limits. Higher and higher fidelity in color and tone reproduction, temporal refresh rates, and graphical photorealism are challenging conventional wisdom of how the human visual system responds. This session will explore new data from various characterizations of visual perception trends and will address potential impacts on image quality.

10:30 AM - 2:00 PM   **Exhibits Open at 10:30 AM - Ray Dolby Exhibit Hall and Centennial Exhibit Hall**

New Technologies & Techniques Part 2 - Salon 1

10:30 AM - 11:00 AM   **How Artificial Intelligence and Machine Learning Will Change Content Creation**
Methodologies.....181
Salon 1

For almost 30 years, Digital Nonlinear Editing Systems (DNLEs) have functioned as a practical replacement for film and videotape editing methodologies. However, while DNLEs have certainly progressed in their capabilities by offering increased video resolutions and visual effects capabilities, they have not fundamentally changed their operational constructs. An editor still must choose the in points and outpoints of a shot and then methodically edit those shots together into a cohesive sequencing. Technology improvements in Artificial Intelligence and Machine Learning are going to profoundly impact how DNLE systems operate and, in turn, how content creation methodologies will dramatically change. This paper will examine the effects of image recognition, natural speech processing, language recognition, cognitive metadata extraction, tonal analysis, and interactive game engine technologies on the creation of content and the resulting operational changes to DNLE operation and workflow.

Speakers: Tom Ohanian

Emerging Research in Visual Perception - Salon 2

10:30 AM - 11:00 AM   **Hitting the Mark - A New Color Difference Metric for HDR and WCG Imagery.....168**
Salon 2

With the emerging demand for high-dynamic-range (HDR) and wide-color-gamut (WCG) technologies, display and projector manufacturers are racing to extend their color primaries in the cinema and in the home. With these brighter and wider colors, the question is: in calibration, how close is close enough? This answer is increasingly important for both the consumer and professional display/projector market as they balance design trade-offs. With HDR/WCG technology, an increasing issue is that many of the color difference metrics in common use today, such as ΔE00, substantially deviate from human perception and become unreliable for measuring color differences. This causes under and over prediction of color differences and can to lead to suboptimal design decisions and difficulties during calibration. There is a large amount of perceptual color difference data in the field today, however the majority was collected using reflective surfaces and very little reaches the boundaries of modern display capabilities. To provide a better tool for facilitating design choices, this paper will present a "ground truth" visible color difference dataset. These visual experiments were conducted between luminance levels of 0.1 and 1000 cd/m2 on high dynamic range laser cinema projectors with approximate BT.2100 color primaries. We will present our findings, compare against current metrics, and propose specifying color tolerances using the ΔICTCP metric for HDR and WCG imagery.

Speakers: Elizabeth Pieri,
Jaclyn Pytlarz

New Technologies & Techniques Part 2 - Salon 1

11:00 AM - 11:30 AM   **Access to Virtualized FPGA Ressource.....N/A**
Salon 1

With the event of imaging in the cloud, new application perspectives are opening. Classical infrastructure can now be addressed by cloud technologies: Routing, Image Compression, Streaming, ... but new solutions can now grow and bring tremendous opportunities for content owners, broadcasters and streamers: Auto image indexing, auto image calibration and editing, etc... They are base to the latest advance in artificial intelligence namely with the Convolutional Neural Network that are now capable of learning complex scene and

interpreting object nature, position and movement. To, actually, benefit of these new technologies, cloud based processing will need an incredible amount or processing power. Virtual Machines based on CPU and GPU can partly address the need but FPGA based hardware are more efficient in terms of power consumption and compactness which are key demand of cloud equipment. Unfortunately, FPGA resources have been hard to access, to program and to integrate in cloud environment. Today, multiple hardware vendors are now working on providing an easy access and flexible resource allocation for FPGA based hardware. This presentation will review how to address FPGA resources through the cloud, how to integrate them into production and post production workflow, and finally how it will impact the entertainment industry on the upcoming years.

Speakers: Jean-Francois Nivart

Emerging Research in Visual Perception - Salon 2

11:00 AM - 11:30 AM   **Assessing Psychophysics Functions for Framerate Perception.....18**
Salon 2

In past research at Rochester Institute of Technology (RIT), a temporal texture space was defined. It was used to classify what attributes contribute to perceived motion quality of stroboscopic reproductions. One of these attributes was determined to be the content's captured and displayed framerate. Using knowledge from this and other past framerate research and psychophysics, a comprehensive experiment was set up to see if a just noticeable difference (JND) could be found for changes in framerate. Thresholds were tested starting with base conditions of 24 FPS, 48 FPS, and 72 FPS due to their significance to the motion picture industry. After a verification pilot study, 77 participants in total participated in the experiment. The collected data points to a resulting JND threshold between 26 FPS and 28 FPS for the 24FPS test point, but a significantly noisier psychophysics signal was present for both the 48FPS and 72 FPS test points. Reason for this nosier signal suggests a lack of detectability in human perception at these higher framerates. This experiment is presented as one in a series of studies into stroboscopic motion perception at RIT.

Speakers: Elizabeth DoVale

New Technologies & Techniques Part 2 - Salon 1

11:30 AM - 12:00 PM   **Real-Time Measurement of Ultra-High Definition Camera Modulation Transfer Function.....N/A**
Salon 1

The spatial performances or resolutions of UHD 4K/8K cameras are of primary importance. High-resolution images elicit the sensation of realness, the quintessence of UHD. We present a system capable of measuring the modulation transfer function (MTF) of a broadcast camera based on its knife-edge responses in real time. The measurement system consists of a PC with a frame memory fed with an HD-SDI video signal in its linear range. This method can be applied to multiple edges in arbitrary directions, unlike the conventional slanted-edge method in the ISO 12233 standard in which only a near-horizontal or vertical edge in a rectangular region of interest can be analyzed. The new measurement system significantly facilitates the evaluation of the performances of the camera and lens as well as accurate focusing in an objective manner. If the optical axis of a zoom lens surface is directly facing a large knife-edge chart with the edge positioned at the image center, the MTF can be continuously observed from the wide end to the telephoto end while operating the zoom, making it very easy to adjust the flange focal distance as well as to obtain the spatial resolution characteristics over the zoom range. The lens aperture that maximizes the MTF, which is usually between F3 and F4, can be found by continuously analyzing an off-axis edge while controlling the iris. Analysis of multidirectional edges on a starburst chart yields a contour plot of multidirectional MTFs that enables direct observation of the anisotropy due to not only the camera and lens performance and conditions (e.g., misalignment of the optical axis of the lens and image sensor), but also the pixel structure of the image sensor and image processing (e.g., demosaicing and detail adjustment). Thus, the real-time multidirectional MTF measurement system provides a means of thoroughly assessing the spatial resolution performances of UHD cameras, thereby enabling the sensation of realness to be achieved.

Speakers: Kenichiro Masaoka

Emerging Research in Visual Perception - Salon 2

11:30 AM - 12:00 PM   **Is Seeing Still Believing: A Critical Review of the Factors that Allow Humans and Machines 206**
Salon 2

Is Seeing Still Believing: A Critical Review of the Factors that Allow Humans and Machines to Discriminate Between Real and Generated Images. This paper will present the audience with the following three key insights: 1) the future application of hyper-realistic computer generated moving images in the context of News and Factual content via conventional broadcast channels and social media platforms, 2) an understanding of the human visual perception factors that allow humans to discriminate between "real" images captured by a camera and generated images by 3-D CGI compared to the image processing factors that allows Computer Vision to discriminate between the same images, 3) the implications of the aforementioned to hoax and propaganda by State or adversarial agencies to generate "fake

news". For the purposes of this paper it will be argued that CGI (photorealistic moving images) will reach a point where they are indistinguishable from real images.This paper is primarily a research / theory oriented paper, and also includes insights into potential applications of the presented capabilities. Research and evaluation by the author has been undertaken into what extent human viewers can discriminate between real (camera-acquired) and photorealistic (CGI) video. Human visual perception candidate factors will be presented, which include: degree of scene complexity, correlation of angular light rays, depth, and other image factors. Computer Vision factors to automatically discriminate include: wavelet-based, noise-based features, and point spread function. The automatic discrimination presents measurements based on Support Vector Machines and other similar machine vision processes. A major element of the research was a technical evaluation of the artefacts within the 2015 terrorist video of the burning of the Jordanian pilot (the video will not be presented). The consideration for broadcasters is the generation of completely faked video, or the synthesis of real and generated images.Furthermore, Martyn will present the contemporary and future epistemological and technical challenges for governments, broadcasters, and viewers, which will ultimately lead to challenges in trust about the media world that we have created.In looking to the future: it is only a matter time until video, in a television news context, is thrust upon us, where not a single photon, a single pixel, a single line, a single frame, or a single sound has ever existed in the physical world…

Speakers: Martyn Gates

12:00 PM - 2:00 PM   **Boxed Lunch - Ray Dolby Exhibit Hall and Centennial Exhibit Hall**

Next Generation TV Part 1 - Salon 2

Next Generation TV - Not Your Father's Television - Part 1.....N/A
Salon 2

Chairs: Bobby White (Sunset Bronson Studios, USA)
Date: Thursday, October 26
Time: 2:00 PM - 3:00 PM

Television of today is not that of a generation ago and it continues to change at a rapid rate. What does the future of Media Distribution hold? What will Next Generation TV look like and what will it mean to you? Change and new technology have been constants in the TV industry. This session will focus on the changes and challenges broadcasters are facing right now and look at options available. From surviving the repack to ATSC 3.0 , what does it mean to be a broadcaster in this brave new world?

Digital Revolution in Data Mgmt Part 1 - Salon 1

Digital Revolution in Data Management - Value Proposition in the Content Business - Part 1 .....N/A
Salon 1

Chairs: Yvonne Thomas (Arvato Systems, Germany)
Date: Thursday, October 26
Time: 2:00 PM - 3:00 PM

Value Proposition in the Content Business
The highest goods in the media business is our content and thus needs high protection and careful management. While standards from ISO, SMPTE and co. support the exchange and archiving of content, the challenge of handling the mass of data and files remains with the media houses. Therefor they need to carefully look at workflows, metadata generation and what kind of software/hardware they use.

Next Generation TV Part 1 - Salon 2

2:00 PM - 2:30 PM   **The Broadcast Guide to Surviving the Repack, Channel Sharing and Upcoming Transition to ATSC 3:0.....N/A**
Salon 2
The ATSC 3.0 standard is on the verge of completion, which will provide broadcasters with a wide range of benefits based on the ability to comprehensively distribute a hybrid mix of broadcast and broadband IP content to fixed and mobile receivers for the very first time. Yet, it will also require a steep learning curve for broadcasters. This paper will provide a comprehensive overview of the repack, exploring channel sharing options and ways that broadcasters can ensure a smooth migration to the next-generation broadcast television system while still supporting the current (legacy) broadcast infrastructure for the duration of the expected transition phase.The different opportunities and benefits of channel sharing will be explored, including centralized, distributed, and cloud approaches for the generation and management of metadata between two channel-sharing stations. Broadcasters will learn

which PSIP method best fits their requirements under the repack in order to retain appropriate station-level channel branding and service guide information, while maintaining FCC compliance.Moreover, the paper will discuss strategies for getting up to speed with the new broadcast television standard in a real-world environment. Before ATSC 3.0 becomes a complete standard, broadcasters can begin testing various elements of the ecosystem, from file-based monitoring to live encoding and over-the-air transmission. Becoming familiar with the new standard now, in their own facilities, broadcasters can ensure the transition is fast and smooth.

Speakers: Mark Corl

Digital Revolution in Data Mgmt Part 1 - Salon 1

2:00 PM - 2:30 PM   **Building a Cognitive Data Management Strategy.....62**
Salon 1

Data management is the core task of IT, yet it has been sadly undervalued and largely ignored for the past thirty years. Data management problems are often approached from a storage perspective, which leads to vendor lock-in, management complexity, and difficulty incorporating emerging technologies in a heterogeneous environment. However, the unprecedented growth of data - in the 10-60 zettabyte range by 2020 - has larger firms and public cloud services, who are concerned about how they will store all the data cost-effectively, suddenly very interested in developing a data management strategy that combines the latest technologies into a serviceable cognitive data management capability. Media and entertainment has, in many respects, been on the leading edge of the data explosion. It makes sense that they will be on the cutting edge of solutioneering to realize the cognitive data management vision. This paper looks at the drivers of, the requirements for, and the essential functionality of cognitive data management strategy, and how these principles may apply to M&E workflows. In addition, the paper will show how such a metadata-centric approach can help companies overcome data silos and take advantage of any storage technology without impacting users, or adding IT management complexity.

Speakers: Floyd Christofferson

Next Generation TV Part 1 - Salon 2

2:30 PM - 3:00 PM   **The Future of Technology in the Future of Broadcasting.....N/A**
Salon 2

Change remains constant in the world of broadcasting. In fact, what it means to be a broadcaster is undergoing great change in the world with OTT and other new services. But a question remains that is of great importance to the SMPTE audience. What is the future role of technology and technologists in this new era.Just as we are seeing a move to cloud and XaaS (everything as a service) inside of technology, it is also arguable that the same trend applies to the role of the people in technology groups We have seen various waves of outsourcing and differing models in the approach to technology in media. But as we see the greater and greater use of commoditized technologies what is likely the impact on future engineers in this space?This paper will examine some history of technology and engineering in the broadcast space and the role it has played in companies. It will then look at the major technology trends affecting the broadcasting industry and examine how these trends impact the future departments, people, and operations within broadcasters.Issues to be examined:1] The growing use of commoditized skill sets. 2] The potential use of AI to supplement or replace technology staff 3] The business realities of technology departments in major media enterprisesThis paper can be expected to generate a lot of interaction and discussion with the SMPTE audience in the live presentation about our collective future.

Speakers: John Footen

Digital Revolution in Data Mgmt Part 1 - Salon 1

2:30 PM - 3:00 PM   **Exploring Image Corruption in the Workflow, and how to Stop this from Happening.....146**
Salon 1

LTO tape Systems, SAN, NAS, Object Store, RAM, and WAN Optimizers all have configurations available to protect the fidelity of image contents in the workflow. Each system has different methods to ensure that frames contents aren't corrupted, and each method protects against a variety of different failure conditions. And yet, unrecoverable frame corruption still occurs at an unacceptable level. This problem is even more serious in an archive scenario, where content may sit untouched for a long duration, and with the corruption staying undetected for extended periods of time.Media and Entertainment workflows rely solely on the protections provided by the underlying compute, storage, and transmission technologies to ensure the fidelity of the data in the workflow. These protections are very difficult to fully characterize and track, because the technologies are generally deployed deep in the hardware or at the lowest software levels of the IT infrastructure. Depending on the path a frame takes through the workflow, it will be treated to a varying set of protection technologies, like RAID, erasure coding, ECC Memory, and parity checking. To overcome the uncertainty of associated with how these methods ensure fidelity, the industry employs failure detection at each stage of the workflow (generally MD5 checksums). When a corrupt image is detected, the entire file must be restored from a backup copy. This approach is very expensive and introduces significant delays in the production when errors occur.This paper will explore the IT technology utilized in the workflow, and discuss the protection

mechanisms provided or employed by each workflow element. In this context, the paper will discuss how frame corruption can occur, even when all of the protection technologies are working as designed. The paper will also discuss a method for providing protection to images at the frame level using Forward Error Correction, such that there is uniformity of protection for images applied throughout the workflow, and such that media errors may be recovered in most cases without having to access a backup copy.

Speakers: Keith Hogan

3:00 PM - 3:30 PM   **Thursday Afternoon Coffee Break - Ray Dolby Ballroom Terrace**

Next Generation TV Part 2 - Salon 2

Next Generation TV - Tools of the Trade - Part 2.....N/A
Salon 2
Chairs: Bobby White (Sunset Bronson Studios, USA)
Date: Thursday, October 26
Time: 3:30 PM - 5:00 PM

As the television industry advances towards new technologies and methods of creation, distribution and consumption, new tools are needed. In this session we will cover captioning, SCTE triggers and adaptive bitrate streaming. Come learn what it will take to thrive in the new world of broadcasting - from a technology standpoint and required skill sets.

Digital Revolution in Data Mgmt Part 2 - Salon 1

Digital Revolution in Data Management - Value Proposition in the Content Business - Part 2.....N/A
Salon 1
Chairs: Yvonne Thomas (Arvato Systems, Germany)
Date: Thursday, October 26
Time: 3:30 PM - 5:00 PM

Value Proposition in the Content Business
The highest goods in the media business is our content and thus needs high protection and careful management. While standards from ISO, SMPTE and co. support the exchange and archiving of content, the challenge of handling the mass of data and files remains with the media houses. Therefor they need to carefully look at workflows, metadata generation and what kind of software/hardware they use.

Speakers: Richard Welsh

Session Chair: Marc Zorn

Next Generation TV Part 2 - Salon 2

3:30 PM - 4:00 PM   **Captioning and Subtitling for Social Media.....74**
Salon 2
Unlike closed captions and subtitling for TV Broadcast, social media platforms offer very limited support for TV producers who are looking to publish promotional content on social media. Often, critical formatting such as positioning on the screen and splitting captions are not possible with popular social media platforms. In addition, many content producers are burning-in their subtitles to get more attention on Social Media feeds. In some cases, a social media platform may not support captions of any kind when streaming live feeds or uploading pre-recorded promotional videos. This becomes a challenge to broadcasters who want to repurpose TV closed caption data to social media. While captions and memes seem to be all the rage in viral social media posts, content producers are publishing promotional videos with captions to stay competitive. The captions and subtitles are becoming important to all mobile users. The average user does not use audio when using social media on the go. Therefore captioning and subtitling is an essential part of publishing to social media. Publishing captioned and subtitled content to social media doesn't have to be a difficult manual task. There are many ways to automate this process along with transcoding and delivery of video with captions or subtitles. Today broadcasters can leverage speech to text tools, caption authoring, and transcoding mechanisms that support publishing video with captions to social media. This paper takes a look at the challenges and formats associated with publishing captioned and subtitled content in Social Media. We will discuss the various caption files that are currently supported by the popular social media platforms. Also, we will examine the pros and cons to doing burn-in subtitles. As some broadcasters are obligated to publish content with captions due to strict government regulations, social media platforms may need to change their caption deliverables to support proper accessibility standards. Finally, we can look at various pitfalls of captioning that could cost broadcasters time and money when

publishing to social media.

Speakers: Giovanni Galvez

Digital Revolution in Data Mgmt Part 2 - Salon 1

3:30 PM - 4:00 PM   **Standards, Media Archiving & Designing a Long-term Data Set.....N/A**
Salon 1

With the conversion to file-based workflows the traditional media library is becoming a relic of the past. Traditional media libraries consist of media on shelves, much as libraries of books existed for centuries. Labelling and cataloging effectiveness have varied widely in both quality and consistency. Existing media collections must continue to be used in a file-based world, and born-digital files must be preserved for current and future needs. But unlike film and analog audio records, digital storage media do not last and are subject to corruption over a comparatively short period of time. They require good cataloging and descriptive skills to be maintained and accessed effectively as time marches on. End-to-end planning for how data is created, flows through production and distribution systems, and finally is stored in a long-term archive is essential to make sure the industry makes the transition as effectively as possible. Leveraging the past decade's experience in media conversion to digital files and receiving born digital content at the Library of Congress, this paper will provides concrete examples, lessons learned, and possible paths forward for media organizations large and small to effectively deal with designing a media data set for long-term survivability. Covered subjects will include the different standards available today to create media types likely to survive for the long-term; how metadata is important and what tools are and aren't available today to create, use and pass along metadata; what key planning factors are important for designing a workflow that builds an effective long-term media archive; and what the challenges of storing data for the long-term are and what tool sets are available today to begin to address the challenge. Also covered will be the skill sets necessary to operate such a media archive, and how to convert existing physical media libraries to file-based workflows.

Speakers: James Snyder

Next Generation TV Part 2 - Salon 2

4:00 PM - 4:30 PM   **Does Capping the Encode Bitrate Really Cap Streaming Quality?.....N/A**
Salon 2

Watching video over the Web is the most popular way to access both free and premium content on connected devices. The technology, HTTP adaptive streaming, consists of fundamental building blocks, which greatly improved the viewer experience over the non-adaptive approaches, however, the technology can still benefit from smarter near-constant-quality encoding schemes tailored for advanced client implementations. In this paper, we present adaptive streaming of content that is produced using capped variable-bitrate encoding. We describe the MPEG DASH toolset that enables the smooth playback of such content. As opposed to only performing content-based encoding, streaming near-constant-quality content provides better viewer experience with minimal cost to the service provider.

Speakers: Alex Giladi

Digital Revolution in Data Mgmt Part 2 - Salon 1

4:00 PM - 4:30 PM   **NABA DPP: Specifications, Standards, and Content Delivery 251**
Salon 1

The seemingly simple act of getting content from its producers to major media outlets is far from simple. Content delivery specifications spanning dozens of pages leave many bewildered, and often result in content being delivered in far from an on-air ready state.The North American Broadcasters Association (NABA), in conjunction with the Digital Production Partnership (DPP), has been hard at work fixing this. Through the novel use of both specifications and standards, the NABA DPP effort has resulted in a standardized set of tools that enable a far simplified and more automated workflow when it comes to delivery of content to those who get it to the consumer.Existing SMPTE standards, such as IMF and BXF, have been leveraged to make delivery of Air Ready, Library, and Archive Masters possible in a way that allows for greater interoperability and automation, resulting in great advances in efficiency and in quality of these files.We will outline how this approach of utilizing both specifications and standards together results in a whole that is greater than its parts.

Speakers: Christopher Lennon,
Clyde Smith

Next Generation TV Part 2 - Salon 2

4:30 PM - 5:00 PM   **Out of Band SCTE 35.....265**
Salon 2

SCTE 35 - "Digital Program Insertion Cueing Message for Cable" - is now routinely used to identify the location and composition of programming content and advertising breaks in linear television for OTT providers. SCTE 35 specifies metadata that can be inserted into the MPEG-2 Transport Stream carrying the compressed content. SCTE 35 contains the precise

frame of the beginning and end of video segments, content identifiers and rights-related information. However, the real-world implementation of SCTE 35 by content providers is inconsistent despite SCTE 67 - "Recommended Practice for SCTE 35 Digital Program Insertion Cueing Message for Cable". Worse, the ever-increasing complexity of distribution and transcoding for delivery to multiple devices has taken its toll on SCTE 35. It rarely survives delivery to the OTT provider without being corrupted. This is obviously a problem for both the OTT providers and the content providers not only because it limits their ability to monetize the content but also because it makes it much harder to effectively automate the implementation of the complex rights associated with online content in an auditable manner. This technical paper will describe a method of delivering SCTE 35 out of band using temporal fingerprints to re-synchronize the SCTE metadata with the video at each receive point. This not only solves the core problem but provides many side benefits including automatic lip sync error correction, enabling broadcast adverts to become 'clickable' and enabling graphics to become customizable and user selectable.

Speakers: Roger Franklin,
Alan Young

Digital Revolution in Data Mgmt Part 2 - Salon 1

4:30 PM - 5:00 PM   **Can Advanced Technology Reduce the Need for Security Audits and Compliance? (A panel discussion).....N/A**
Salon 1

We constantly explore new technologies that will help us create and manage content. The need for better security is obvious, especially after high-profile losses. Yet we dread having to "experience" an audit to make sure we're paying attention to that need. If we invest in digital certificates, encryption, hashing, forensics, compression, and other technologies, do we also need to be audited every year? Let's talk about it.

Speakers: Conrado Niemeyer,
Richard Welsh,
Marc Zorn

Moderators: Yvonne Thomas

6:30 PM - 9:30 PM   **Annual Awards Gala (Ticket Required)**
Hollywood Ballroom

Join us as we honor industry luminaries. The Annual SMPTE Awards Gala will take place on will feature a red carpet, reception, and dinner in the Hollywood Ballroom of the Loews Hollywood Hotel. Annual Awards Gala (Ticket Required): Red carpet arrivals and cocktail reception will begin at 6:30 pm, followed by the Awards Ceremony and Dinner at 7:30 pm. Awards Gala Afterparty follows from 9:30 – 11 pm. Remember to purchase your ticket with your conference registration! Tickets are limited! Dress in your finest Hollywood Glamour, black-tie is optional.

9:30 PM - 11:00 PM   **Awards Gala Afterparty**
Canyon Rooms