RISING TIDE OF UHD CONTENT INTENSIFIES NEED FOR ADVANCED SECURITY MEASURES
Introduction

With online theft of premium video continuing to cause industry concern as the introduction of higher quality video formats accelerates, there is increasing agreement that the time has come to implement forensic watermarking as a primary weapon in the fight against piracy.

It’s long been understood that the emergence of distribution services carrying content formatted to ultra HD (UHD) and high dynamic range (HDR) parameters would trigger a pan-industry move to more rigorous levels of content protection. With a huge base of 4K UHD TV owners now in place, the flow of enhanced-format content is intensifying rapidly.

Watermarking, entailing automated insertion of invisible digital codes that can associate a stolen piece of content with the viewing device and its owner at the point of theft, is the best tool rights holders have to find and act against commercial content pirates who attempt to capture and redistribute live and on-demand video streams. Consequently, after a long period of uncertainty about how serious the watermarking mandate might turn out to be, pay-TV and OTT distributors should anticipate wide-scale adoption of content licensing policies that put watermarking at the center of new requirements for securing end-to-end distribution of premium video.

The contours of new requirements, including watermarking, for protecting high-value content can be found in the Enhanced Content Protection (ECP) specifications set by Motion Picture Laboratories (MovieLabs), the Hollywood studios’ research and development joint venture. While the MovieLabs specs may be implemented in different permutations by license holders, watermarking is a fundamental component that has been widely embraced by studios and other program suppliers as they prepare to push ever more UHD Premium and other high-value content through big pipes that support TV viewing at unprecedented levels of quality.

Fortunately, a solid foundation for enabling practical use of watermarking has been built by Verimatrix and other content security suppliers working in tandem with SoC (system-on-chip) manufacturers, CE OEMs, distributors and license holders worldwide. Moreover, the Verimatrix Video Content Authority System (VCAS) Ultra™ architecture undergirding the company’s VideoMark® watermarking solution encompasses all the capabilities essential to implementing the other measures embodied in the MovieLabs specs, including rigorous approaches to hardware and software layers of security that are needed to provide ironclad protection in the distribution chain end to end.
Along with maturation of protection technology and adoption of licensing policies that are putting these capabilities into play, another line of progress confirming the time has come for watermarking has to do with industry-wide collaboration on building a viable forensics tracking and enforcement ecosystem with enough clout to put pirates out of business. Mounting evidence of success in the execution of enforcement initiatives has reinforced content owners’ confidence that inclusion of watermarking requirements in their licensing agreements with distributors is going to pay off.

We begin the three-part discussion that follows by exploring the trends driving what promises to be an ongoing surge in UHD Premium content availability and, with it, an escalating threat from piracy to the bottom lines of all concerned. We then examine the prescriptions MovieLabs has set for watermarking and other advanced protection measures with a review of the steps Verimatrix has taken to give content owners and distributors the tools they need to meet those requirements. We’ll conclude with a brief review of what has been done so far and what needs to be done to establish a global enforcement framework that can maximize the effectiveness of watermarking against piracy.

**UHD Set Sales and Consensus on Premium UHD**

The need for watermarking and other advances in content security is rising in direct proportion to developments along two inter-related trend lines: 4K UHD TV set sales and availability of UHD content. Where display sales are concerned, Strategy Analytics projects that one in every eight homes in North America will have at least one 4K UHD display by the end of 2016. 1

While overall global TV sales flagged a bit in 2015 due to saturation of flat-panel TVs in most markets, sales of 4K UHD sets soared by 160 percent over the previous year, reaching 32 million or 14 percent of all types of sets sold worldwide, according to a report from Futuresource Consulting. By 2020 the annual global 4K UHD sales total will approach 140 million, representing 52 percent of the TV market, Futuresource predicts.
These projections square with those of other research firms. For example, IHS Markit, citing plummeting prices, predicts 4K UHD TV household penetration in the U.S. will reach 34 percent in 2019, followed closely by the U.K. at a projected 31 percent penetration. IHS foresees 4K UHD set penetration hitting 25 percent in the European Union by that year, followed by China at 24 percent and Japan at 14 percent.

Notwithstanding the fact that 4K UHD TV sets have been on retail shelves since 2012, there was very little UHD content available through the first years of 4K set production, primarily because the benefits that came with merely quadrupling pixel density to 4K parameters didn’t produce an improvement in viewing experience that merited investment in everything that had to be done from production through distribution to deliver UHD content. This perspective changed with the enhancements to the viewing experience introduced through increases in luminance and color ranges of not only 4K but also HD content as prescribed by various iterations of HDR technology.

However, while HDR generated excitement that a truly new level of TV quality capable of driving new consumer spending on displays and content was at hand, there was no consensus on HDR parameters and, therefore, no way to build a mass market. To rectify the situation several leading CE manufacturers, Hollywood studios and other interests at the outset of 2015 formed the UHD Alliance (UHDA) with a mandate to reduce the confusion generated by competing HDR templates so that consumers could be confident the displays and Blu-ray players they were purchasing would have access to the widest possible range of HDR-enhanced content.

A year later, the alliance announced agreement on HDR parameters which, together with 4K, would determine which TV sets merit the organization’s “Ultra HD Premium” stamp of approval. Baseline requirements include: 3840 x 2160 resolution; 10-bit coding; SMPTE 2084 transfer function; at least 1000-nit peak brightness or 540-nit peak brightness in the case of OLED displays; BT.2020 color gamut representation on signal input, and display reproduction able to render more than 90 percent of the colors in the SMPTE DCI P3 standard used for cinematic productions, which is a significant subset of the BT.2020 color gamut.

As of mid-2016 more than 30 display models had been certified Ultra HD Premium compliant, including the entire line of Samsung SUHD TVs, all of LG’s 2016 vintage OLED displays, larger Panasonic DX-900 models and many more. While Sony has chosen to use its own labeling for HDR-enhanced UHD sets, the firm says its flagship 2016 XD93 and XD94 models comply with the UHDA’s Ultra HD Premium specifications.

In addition, two manufacturers, Panasonic and Samsung, are offering Ultra HD Blu-ray Disc players that meet new Blu-ray Disc Association specifications paralleling those of the UHDA. Many more OEMs are set to introduce UHD players in the coming months.
Operating in tandem with the UHD Alliance, the Ultra HD Forum, a consortium with more than 50 members consisting primarily of MVPDs, their suppliers and OTT vendors, has developed guidelines prescribing an end-to-end workflow for constructing and delivering HDR-enhanced content as a real-time linear service. The first set of guidelines contains separate sections dedicated to each step in the distribution chain, including compression technologies, metadata carriage options, sample bitrate ranges, audio, captions/subtitles and more. Consideration is also given to content manipulation that may occur at each point in the chain, such as ad insertion and graphic overlays.

Significantly, by making its guidelines applicable to HDR enhancements to HD content viewed on HDR-capable 4K screens, the Ultra HD Forum has set the stage for a greater volume of premium content meriting advanced protection via watermarking and other techniques than would be the case if HDR was limited to use with 4K-formatted content. While some HDR-capable 4K UHD displays automatically enhance HD content with luminance and contrast levels that offer dramatic improvements over conventional HD displays, the Ultra HD Forum’s guidelines go farther by prescribing pre-distribution processes that can be applied to enhance HD content to full HDR and WCG (wide color gamut) parameters for rendering on any HDR-capable display.

As a result, HD 1080p is factored into the forum guidelines as a UHD format in instances where the HD content is enhanced with HDR. These steps recognize that HDR rather than the level of resolution is the key to enhancing the viewing experience and therefore the value of premium content to viewers and thieves alike.

The UHD Content Surge

The industry’s consensus-building activities have triggered a rapid rise in the volume of UHD Premium-compliant content...
available to consumers. In the OTT domain, Netflix and Amazon have led the way in adding HDR-enhanced programming to the 4K UHD lineups they’ve been building over the past two years. Netflix, the first SVOD OTT service to offer 4K-formatted content, has committed to producing all its original series in 4K and has been rapidly adding HDR-enhanced content to that mix. Amazon Prime is now offering more than 30 movie titles and five original series in UHD Premium mode.

Elsewhere on the OTT front newcomer UltraFlix, as its name implies, is pinning its business model to delivering industry-leading volumes of UHD content with an initial offering of over 300 hours of 4K movies and other content on demand, some of it with HDR enhancements. Other suppliers like Vudu, M-Go and Sony with its new Ultra streaming app are populating the Internet with ever more UHD Premium-formatted options. And YouTube, which over several years has built a sizeable library of 4K content, has brought long-form HDR-enhanced UHD content into the mix of channels offered on its Red subscription platform.

As the online availability of 4K UHD content continues to ramp up, an even more significant development is the emergence of the first live TV broadcasts of 4K UHD in the U.S. and elsewhere. The debut of such programming in the U.S. occurred with CBS Sports’ coverage of the Masters Tournament in March broadcast by DirecTV. This was preceded by a spate of live 4K UHD broadcasts elsewhere, including productions of NHL and NBA games in Canada and multiple soccer telecasts by BT Sport in Europe.

Since then an even greater volume of 4K broadcasts covering Major League Baseball games, albeit without HDR enhancements as yet, have been produced for distribution in the U.S. and Canada, including all the home games of the Toronto Blue Jays delivered to Rogers Communications’ Sportsnet subscribers and a handful of other MLB “showcase” games delivered by DirecTV. NBC Universal contributed to the flow with one-day delayed broadcasts of several Olympic events in HDR-enhanced 4K with distribution over 4K UHD feeds operated by Comcast, Dish Network and DirecTV.

So far, MVPD distribution of 4K UHD content in the U.S. has been limited with only DirecTV going so far as to allocate multiple TV channels to the format. This entails one full-time linear, one pay-per-view and a part-time linear, all of which are accessible by top-line premium subscribers with the help of a new 4K-capable Genie Mini set-top connecting to designated models of Samsung, Sony and LG TVs. With launch of a satellite dedicated to supporting 4K UHD, DirecTV is well positioned to quickly expand the content offerings.

Dish has limited its broadcasts to occasional events like the Olympics and is also offering pay-per-view movies and 4K UHD series from Netflix. But Dish executives say more is in the offing for access via a new 4K-capable Joey set-top and Hopper 3 DVR.

Comcast has begun to expand on its initial Xfinity UHD offering, which uses a streaming app to enable owners of Samsung and LG 4K UHD sets to view a mix of episodic programming primarily from Comcast-owned NBCU over their broadband connections. The MVPD, after announcing separate rollout plans for 4K and HDR set-top boxes in 2016, has decided to focus strictly on HDR-enhanced UHD set-tops using advanced HEVC compression suited to HDR requirements. The company was expected to introduce the set-top by the end of 2017.
Another major development expanding availability of 4K UHD content is the studios’ release of a growing number of Blu-ray 4K UHD movies now that the new players are coming onto the market. There were about 50 titles available by mid-2016 with industry projections anticipating the total would reach 100 by year’s end. As of late June these early releases had generated sales of 228,000 discs, a significant increase over the 57,000 Blu-ray discs that were sold during a comparable period when Blu-ray players launched in 2006.

1 Forbes, _Everybody Wants 4K_, May 2016,
3 IHS Markit, _TV Sets Intelligence Services_, December 2015
4 Light Reading, _Comcast Has a New Timeline After 4K Delay_, March 2017
5 Trusted Reviews, _The Ultimate Guide to 4K Blu-ray Movies_, August 2016
6 Home Media, _Early Blu-ray Ultra HD Sales Numbers Exceed Disc Predecessor_, June 2016

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