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ULTRA HD: WINNING THE BATTLE FOR THE BIG SCREEN



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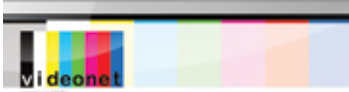
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Videonet explores the business and technology challenges faced by the TV industry as it introduces more high-definition and on-demand content and evolves towards a multiplatform and connected TV experience.

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INTRODUCTION

This report tackles some of the issues that are little covered when it comes to UHD, like what the whole user experience and UI should look like when you have much more screen real-estate available, the content security considerations, as driven by MovieLabs, and what UHD means for whole-home viewing. However, we start by looking at whether Pay TV operators need to wait for higher frame rates and better colours to achieve enough of an improvement, in comparison to HD, to 'sell' UHD. We also take a look at how the 4K set market is developing. We hope this is a useful addition to your UHD/4K reading.



John Moulding, Editor, Videonet

Cover and main spread photos: Screen shows UHD UI in a 'dashboard' presentation, developed as part of NAGRA's Project Ultra

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INTRODUCTION:

The Battle for the Big Screen

By **Anthony Smith-Chaigneau**,
Senior Director Product Marketing, **NAGRA**



4K Ultra HD is making its mark as the next TV format that is set to transform the living room by offering an unparalleled entertainment experience. Huge advances in screen technology have put the industry in a position to transform consumer viewing even more than HD did more than a decade ago. NAGRA believes that pay-TV service providers who offer 4K Ultra HD are neatly poised to maintain and naturally expand their dominant role in the home entertainment arena as a result of new and innovative user experiences, use cases and the home cinema effect that is brought about by this new BIG SCREEN TV environment.

With twice the horizontal and vertical resolution of the 1080p HDTV format and with four times as many pixels overall, 4K offers much finer detail and greater texture. We could talk about better dynamic range, colour gamut, frame rates and other attributes of the technology that are equally pertinent at smaller screen sizes; however this is mostly lost on the consumer who is faced with sales pitches that all revolve around immersive TV experiences. The 4K Ultra HD screens now range from 40-inch to 110-inch with a lot of emphasis on 55-inch displays and higher with prices falling at a rate suggesting a tipping point sooner than expected for mainstream consumers.

Talking of immersion, Josh Sapan, President and CEO of AMC, told a large gathering of TV executives recently that their ‘TV shows’, such as Breaking Bad and Walking Dead, are produced and created to offer up a pure cinematic experience. So it is safe to say that the BIGGER THE SCREEN, the greater the effect and the better the experience – ‘Real’ Home Cinema without a projector, but imagine with a 4K projector – Wow Factor! We do understand that there is some skepticism due to the fact 4K Ultra HD content is lagging the technology play, however ad interim there is also the wow-factor delivered by up-scaled HD and re-mastered Blu-Ray. Early adopters are still being wooed with a rewarding 4K experience despite the need for alignment of all the parts of the value chain.

The full roll-out of a 4K Ultra HD service is, however, undeniably quite a journey that will ultimately entail a rejuvenation of the end-to-end media delivery infrastructure and for this to become the rewarding experience it promises to be the industry needs to get this right along that

end-to-end path. We need to fundamentally rethink many elements ranging from how content is being managed, encoded, secured and finally presented to the consumer.

What we also see is that this new BIG SCREEN format dictates that broadcasters and, even more so, Pay-TV service providers will need to up the ante and deliver a more relevant use of technology at the consumer home, considering the amount of screen real-estate that the consumer has before them. Rather than simply displaying a full screen image, the underlying power of the format means that a user interface (UI) can incorporate features that have simply not been possible before. For example, larger screen formats will be able to deliver a wide range of new interactive experiences leveraging exciting Ultra HD video quality. At NAGRA, we have been preparing for the new TV experiences and the new market that is set before us. One example is our 4K User Experience that allows consumers to interact more naturally with the screen, while providing an unparalleled and immersive viewing experience that blends together ease of search and navigation, social integration and all types of connected media.

In the new world of 4K Ultra HD television, NAGRA also is ensuring that service providers will be ready to meet the new security standards required to protect the value of premium 4K TV content. The Hollywood studios and their technology joint venture MovieLabs have established a set of requirements for “enhanced content protection” for 4K TV, including watermarking (visible and invisible), the latest scrambling algorithms, and hardware root of trust. NAGRA are working closely with the stakeholders to ensure that products are “4K ready” through a unique combination of time-proven technologies and cutting edge security services that will ensure any broadcaster or Pay-TV service provider can access the premium 4K Ultra HD catalogue required to make their service a success.


So as we march forward with 4K Ultra HD, we believe that the TV set will remain the centre of entertainment for premium content and as the source of unprecedented premium viewing experiences, offering new ways to engage and interact with content, thus giving service providers new opportunities to bring their subscribers “back to the big screen” with services that are engaging, monetized and secure. ●



ULTRA HD: WINNING THE BATTLE FOR THE BIG SCREEN

A look at how the 4K/UHD market is evolving and what is needed for Pay TV operators to differentiate services from both HD and what OTT providers can offer, from higher frame rates and better colours to the UI and all-round user experience that will win consumer attention and admiration. We consider how UHD will fit into the existing television ecosystem, investigating the role of upscaling, new content protection specifications and how we handle in-home content redistribution.

By Adrian Pennington

 **SECTION 1:
PAY TV
ATTITUDES, UHD
SET FORECASTS
AND TRUE UHD**

Ultra HD services are being primed for launch worldwide but while Pay TV operators risk ceding first mover advantage to OTT players, they are putting plans on pause because of reservations about the value proposition in the format's early content production and home hardware incarnations.

"Technically, one could probably launch Ultra HD services today with more pixels and up to 50/60p [frame rate], but it won't be a major step forward from HD. We want to make sure that consumers get a real benefit out of Ultra HD," says Stephan Heimbecher, Head of Innovations & Standards for Sky Deutschland.

Although Japan's state-backed NexTV-F is piloting UHD transmissions, analysts expect the first U.S./European services to come on stream during 2015. "The more aggressive Pay TV operators like BSkyB are planning roadmaps towards fully commercial UHD services," says David Mercer, VP, Principal Analyst at the research firm Strategy Analytics (SA). "Pay TV operators can clearly see value in UHD becoming an essential part of the mix and, eventually, as important as HD is today."

Paul Gray, Director, European Research at DisplaySearch (a research/consulting company specialising in the display supply chain) thinks we are in a classic new technology stand-off: "Nobody wants to ▶▶



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Paul Gray, DisplaySearch ▲

►► move first. I think 2017-18 looks a sensible time frame.”

However, the pressure is building. While some MSO/MVPDs (cable operators/multichannel video programming distributors) are more cautious than others about the speed of the UHD transition, most accept that UHD is a question of when, rather than if.

“Pay TV operators do not want to get left behind by their rivals,” argues Andy Mee, Director of Sales & Marketing at EchoStar, a provider of set-top boxes. “In most markets this means they feel they must launch some kind of UHD service within a year or so.”

Heimbecher says: “Generally speaking, we do believe in the (long-term) potential of Ultra HD and a new viewing experience, which is the reason that we are doing all of our tests and UHD productions. “But the timing is going to be critical.”

Decisions such as those at Sky Deutschland will hinge on a number of factors, not least wider UHD

programme availability and a resolution to the increasingly vexed debate about the most appropriate implementation of the UHD format, a debate which impacts directly on consumer value perception of UHD TV sets and services.

“Where Pay TV operators bear a high percentage of the production costs, the prospect of funding a complete new generation of production equipment (while many are still able to charge a premium for HD) can be seen as unwelcome,” says Mee. “A single channel may be easy enough to justify, but the bandwidth costs of simulcasting a significant proportion of content in UHD will be high. So UHD will initially be rolled out via single channels and one-off productions.”

A future SD switch-off will help to make way for more UHD

that EBU refers to are being brought in under proposals for a Phase 2 UHD and include higher dynamic range (discussed later in this report) but its recently released policy statement argues that an enhanced 1080p format should be developed for broadcasting as a more economical means to improve visual quality in the short-term.

UHD TV SET SALES

Before we head into the ‘more pixels, better pixels’ debate, let’s take a snapshot of the current and predicted status of UHD hardware into the home.

“There has been a lot of wait-and-see around 4K TV sales, but these are now beginning to pick up in Europe and the U.S.,” states Strategy Analytics. “As a result we expect most operators to come under in-

“IN MOST MARKETS PAY TV OPERATORS FEEL THEY MUST LAUNCH SOME KIND OF UHD SERVICE WITHIN A YEAR OR SO”

broadcasting. The timescales for this are likely to be radically different in different markets. Indeed, in some markets HD is still seen as a luxury.

The EBU (which represents public broadcasters in Europe) agrees that the headlong rush towards UHD is not appropriate given the economics of the step change. Its members may not be Pay TV operators but its critique of current UHD TVs as “unsatisfactory” and that “ignoring other enhancements is not a sufficiently large step for the introduction of successful new broadcasting services” hits home the message that UHD is not ready for primetime.

Those other enhancements

creating pressure to announce their UHD plans over the coming year or so.”

Broadly, set penetration figures provide more optimism than a year ago although global sales are skewed by the remarkable appetite for UHD TVs in China.

DisplaySearch expects that 12.3 million 4K LCDs will ship worldwide this year, of which 9.2 million will enter the Chinese domestic market and just over 1 million will enter Western Europe. Futuresource figures match, with this research company adding that North America will account for 10% of the installed base this year and West Europe will ►►



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A Technicolor multi-room DVR ▲

“DEMAND FOR UHD TVS IS EXCEEDING PREVIOUS EXPECTATIONS AND CURRENT ADOPTION RATES ARE SIMILAR TO THOSE OF 1080P TVS BACK IN THE MID-2000S”

► account for nearly 8%, with China taking the lion's share. Global sales will total 43.5 million units (or 38% of total flat panel sales) by the end of 2016, with West European households accounting for 5% by that time, says Futuresource.

“UHD TV sets have come to market much more aggressively than anyone anticipated a year ago with



David Mercer, Strategy Analytics ▲

smaller screen sizes and lower prices,” states Jack Wetherill, Senior Market Analyst at Futuresource. “The market is being seeded by hardware companies and this part of the jigsaw is falling into place much more quickly than the ones relating to content.”

IDC research suggests that the average price tag for UHD TVs has fallen 86% since 2012, from U.S. \$7,851 to \$1,120. Units range as low as \$600 (a 39-inch Seiki) to \$10,000 for an 85-inch Samsung model. Entry-level prices for UHD TVs will drop below \$2,000 before the end of the year from one or more of the major global TV brands (Samsung, LG, Sony and Panasonic), reckons Strategy Analytics. Indeed, UHD seems to be following the traditional ‘S’ curve in which adoption begins slowly before accelerating.

“Demand for UHD TVs is exceeding previous expectations and current adoption rates are similar to those of 1080p TVs back in the mid-2000s,” concurs David Watkins, Service Director at SA's Connected Home Devices service.

The analyst anticipates that global UHD TV shipments will account for 41% of TV displays in 2020,

(leaping from 4% today) and that the U.S. will overtake China in terms of UHD TV household penetration.

HD TO UHD UPSCALING

While the availability of 4K-originated content will lag take-up of sets themselves, early adopters of UHD TVs are being attracted by manufacturer promises of improved picture quality. With this in mind, vendors are working to perfect engines which upscale the content feed that comes into the set.

“Upscaling features are a vital part of their strategy to ensure that 4K TVs appear relevant to consumers today, ahead of native content,” suggests Wetherill.

Vendors are putting a strong marketing focus on the merits of upconverting 1080p to UHD content “until the dam breaks on UHD content and broadcast services begin,” agrees Mercer.

While clearly unable to create information that isn't there, a 4K display is more ‘transparent’ to the incoming signal. “It is rather as if you have cleaned the window pane and can see more clearly what always was behind it,” describes David Wood, Deputy Director, EBU Technical. “You can't get the same quality as you would with a genuine 2160p [4K] source, but it is worth something.”

Blu-ray Players are also emerging which can upscale disc playback ►►

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Keith Wymbs, Elemental Technologies ▲

▶ in a similar way. On the content side, Sony has been issuing ‘Remastered in 4K’ Blu-ray discs to denote that the content was remastered from a 4K source.

“The consumer may be unsure whether such discs are a significant improvement on a regular high definition Blu-ray when it is upscaled by

“PIXEL COUNT IS ONLY PART OF THE UHD STORY. BROADCASTERS ARE LOOKING TO MAKE FULL USE OF HIGHER CONTRAST, WIDER COLOUR GAMUT AND OTHER UHD CAPABILITIES”

a player,” notes Wetherill.

The goal is to roll out ‘native’ 4K players and discs. The Blu-ray Disc Association is working on a specification which they hope will lead to availability of product by the end of 2015.

“The role of disc platforms is in steady decline and this will continue even though we expect a 4K upgrade to Blu-ray to arrive eventually,” says Mercer. “It would appeal to videophiles and movie enthusiasts and would play a limited role in the overall success of UHD.”

It is also worth bearing in mind the Secure Content Storage Association (SCSA) initiative to create an open ecosystem of 4K content for purchase at retail or download for storage or playback on any number of brands of Ultra HD TVs that

support that ecosystem.

THE 64K QUESTION

At present, UHD on retail “is little more than a ‘numbers marketing’ play,” asserts Gray at DisplaySearch. “If an ordinary consumer cannot walk into a shop and immediately see the difference then something is wrong. Pin-sharp, ‘contrasty’ images free from artefacts are a must.”

Pixel count is only part of the UHD story. Broadcasters are looking to make full use of higher contrast, wider colour gamut and other UHD capabilities already written into the UHD specifications in order to differentiate their next-gen services from HD and from upscaled HD.

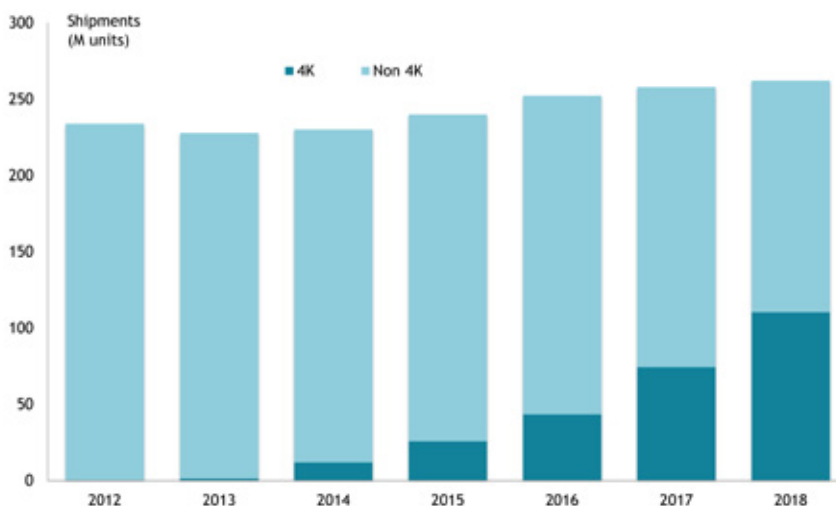
“The viewing experience has to be significantly better than it is with HD,” insists Wood. “The images and sound have to be more like real life, there has to be more ‘wow’. The cost of the set has to seem proportional to the gain, and it has to be affordable.”

More than half of consumers would be willing to replace their existing TV with a UHD TV, assuming that quality and price expectations are met, if we follow SA’s research.

“Consumers are willing to buy a new TV to get further improvements in TV quality beyond HD,” says Mercer. “There is a long way to go before TV producers begin to realise the full benefits of UHD technology as the required tools are only just becoming available and in some cases are considered to have weaknesses.” ▶

4K TV MARKET OUTLOOK

4K to account for 42% of Global TV Sales in 2018



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Futuresource provides its 4K TV sales forecasts ▲

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Anthony Smith-Chaigneau, NAGRA ▲

“CREATING SCREENS WITH HIGHER RESOLUTION IS NOT DOING JUSTICE TO THE QUALITY IMPROVEMENT THAT COULD BE ACHIEVED IF WE APPLY THE FULL TOOLKIT”

these levels will offer the right combination of quality increase, cost and content to be successful.

“That is the 64K question,” says Wood. “A Pay TV operator working via their own set-top boxes has the easiest route to 2160p. It just has to offer new boxes, broadcast (say) via satellite, and if the viewer has a 2160p set, the starting gate is open. There may also be quite a supply of movie content that will look good at 2160p. In principle Pay TV operators have the chance to gain market lead since they can address the market of ‘first users’ with Phase 1 sets.”

But as Wood point out, the equation is not so simple. Operators must estimate whether Phase 1 will offer enough to be successful, or whether to wait for Phase 2 or 3.

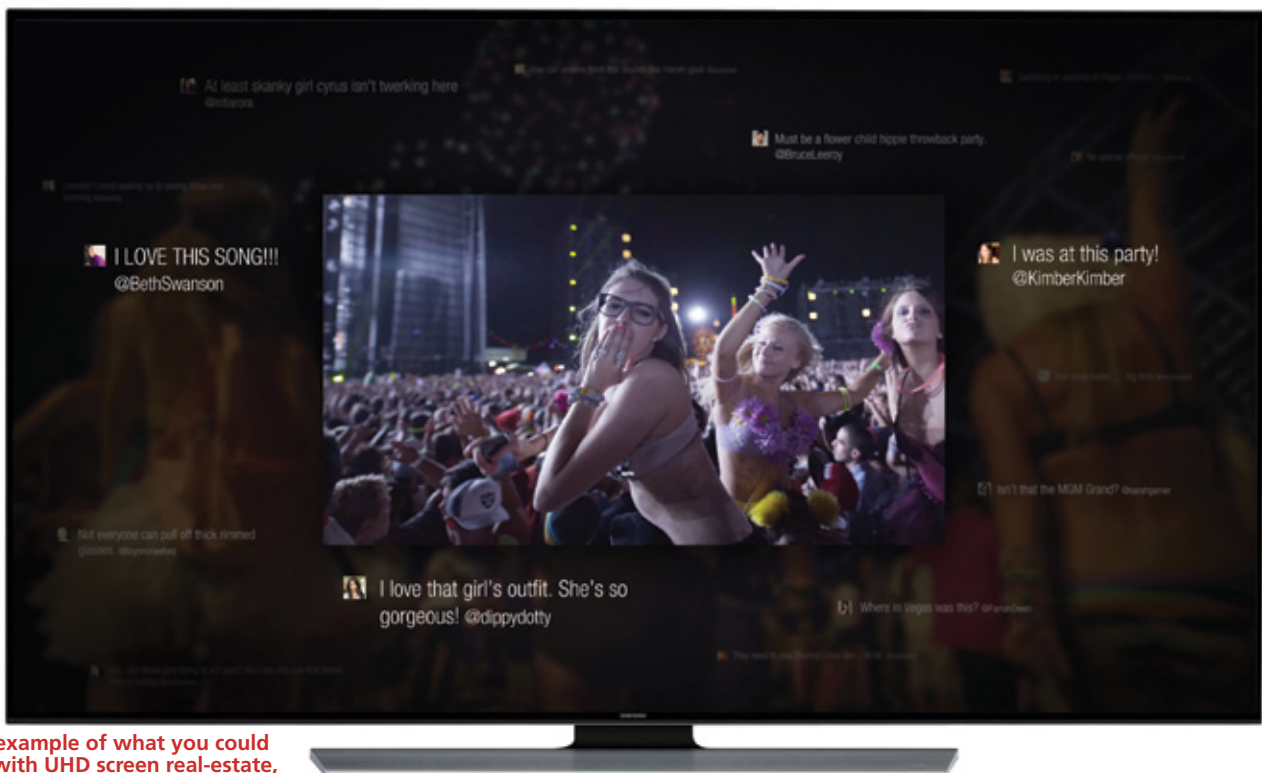
“There is no choice at the moment but to catch the 2160p train. But should we catch the Phase 1 or Phase 2 train? That’s a difficult one. What magnitude of quality leap will be needed to make 2160p successful?”

DYNAMIC RANGE AND FRAME RATE

The notable additional features as you move beyond Phase 1 are High Dynamic Range (HDR) and High Frame Rate (HFR), both tools that may be applied for Phase 2 2160p. Each would bring a significant quality gain for certain types of scenes.

“Creating screens with higher resolution is not doing justice to the quality improvement that could be achieved if we apply the full toolkit ▶▶

▶▶ It is easy to forget that UHD TV has three levels, not just one. The simple, or ‘Phase 1’ 2160p (aka 4K), the ‘Phase 2’ 2160p with added features, or the ‘Phase 3’ 4320p (aka 8K). The issue is whether all (or any) of



An example of what you could do with UHD screen real-estate, by NAGRA ▲

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The Harmonic Electra 9200 encoder, catering for high-end HD today ▲

“IF ULTRA HD SERVICES ARE LAUNCHED TOO EARLY WITH JUST MORE AND NOT ‘BETTER PIXELS’, THIS PROBABLY WON’T DO THE TRICK”

► of potential improvements,” says John Ive, Director of Business Development, IABM (International Association of Broadcasting Manufacturers). “The logic is absolutely sound, but putting those enhancements into practice is a more complicated matter. From a consumer perspective, it is far easier to market the concept of higher resolution.”

HDR expands the range between the darkest and brightest images a screen can produce, provided the viewer has a high brightness



Pascal Portelli, Technicolor ▲

display. The impact on programming is more vivid primary colours, the ability to see more detail in dark areas of images, and the perception of greater image quality. Currently, the International Telecommunications Union (ITU) is considering HDR as an addition to UHD, and is looking at format proposals from companies such as Dolby, Technicolor and the BBC.

High frame rates are considered essential for live sports, as tests by BSkyB, Sky Deutschland and the BBC have confirmed. While playing out 4K movies at the conventional 24/25p would be straightforward, and is helping OTT providers like Netflix and Amazon gain a headstart in 4K VOD, the transition to live UHD production is far more complex.

“High-quality 4K that gives sports and action fans a more lifelike view of motion needs to be produced at 60 frames per second; even 50 won’t cut it,” says Elemental Technologies’ Chief Marketing Officer, Keith Wymbs. “Faster frame rates provide more stable images for camera panning, long zoom shots and fast moving objects, and help mitigate issues like smearing, flickering effects – such as those caused by high LED stadium lights – and blurring.”

Necessarily there will be a

compromise between technical supremacy and commercial reality. “While a case can be made to support 100/120 fps (frames per second), it only exists for the most challenging sports content,” says Wymbs. 50/60 fps progressive can handle the vast majority of content and is supported by HDMI (2.0).

Ian Trow, Senior Director Emerging Technology and Strategy at Harmonic (which provides encoding, transcoding and storage solutions, among other things) adds his view: “When considered along with the increased bandwidth requirements for UHD services, 50/60p will represent the upper frame rate limit in the short to medium term.”

Another key is 10-bit sampling, which Elemental believes is critical for 4K adoption. “10-bit affords a much finer colour gradient and you can combine 10-bit sampling with the broader colour gamut to deliver a completely different visual experience,” says Wymbs.

TWO PHASE ROLL-OUT

The concern is that there will be a two phase UHD roll-out, the first effectively being like HD but with four times the resolution, and the second phase introducing various other improvements.

“The problem for Pay TV operators is that the costs of implementing each improvement fall onto different parts of the value chain,” says Mee. “For example, many cameras are already able to capture a higher ►

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Ian Trow, Harmonic ▲

► dynamic range than current broadcasts can convey, so the exact same footage, captured and processed using existing equipment, yet 'graded' in a different way, can already deliver HDR images. All that is required is a broadcast standard, a medium bitrate increase and suitable consumer displays. But HFR requires brand new equipment and infrastructure

“STOP THINKING FULL SCREEN MODE. WITH A DISPLAY AS BIG AS 105 INCHES, YOU CAN SHOW SEVERAL FEEDS IN PARALLEL OR USE PART OF THE SCREEN FOR ANCILLARY INFORMATION”

throughout the entire production chain, in addition to a broadcast standard, a medium bitrate increase and suitable consumer displays.”

Mee says EchoStar is already considering STBs with both forwards and backwards compatibility, “meaning UHD TVs sold today will be able to display phase two broadcasts via

the STB, while future UHD TVs will deliver even better, brighter, clearer more colourful pictures.”

From a practical perspective, the margins that screen manufacturers operate on places considerable restrictions on the degree to which innovation can be applied to screens. No surprise then that major manufacturers have, to date, drawn a line beyond extending the technology in the display into greater dynamic range and wider colour gamuts.

“While debatable, most of the screens currently available cannot fully utilize the existing HD colour space and this is likely to be the case for some time,” says Trow. “This makes a universal introduction [of advanced UHD features in one go] extremely challenging and a phased introduction likely. While undesirable from a consumer perspective, due to the likelihood of consumer alienation of early adopters, this appears to be the direction the industry is heading.”

Here’s the view of Heimbecher at Sky Deutschland: “If Ultra HD services are launched too early with just more and not ‘better pixels’, meaning with high dynamic range and

extended colour range, for example, this probably won’t do the trick. Most of the current ‘wow’ comes from the fact that flagship UHD displays are at least twice as large as those which consumers have in their homes today.

“However, it will probably be difficult to deeply impress the consumer beyond that early stage of

being overwhelmed by the pure size of the devices. So the risk of launching UHD services - like via OTT - too quickly is that it could lead to the consumer being underwhelmed by it.”

SECTION 2: REAL ESTATE, CONTENT APPLICATIONS AND SMART HOME OPPORTUNITIES

It is worth remembering that as the screen size shrinks the advantage of having a pixel dense display starts to diminish. There’s also an irrefutable relationship between screen resolution and viewing distances.

“Many homes will not have the space for a huge TV,” notes Gray, who believes 50-inches is an entry size. “Probably, only the dynamic range and colour would have an impact at normal viewing distances of 2-3 metres.” Anything outside of that distance using a 55-inch display would mean most observers could not tell the difference between UHD and a good 1080p signal.

Futuresource expects 8% of West European TV sales to be sized 50-inches or more this year; a share that will rise to 13% by 2018. In terms of ownership, this translates into roughly 10% of European households at the end of 2014, and nearer 16% in 2018. DisplaySource anticipates that only 4% of the West European market will be over 60-inches in 2018 but by the end of the decade UHD will become standard in screen sizes larger than 40-inches (Strategy ►►



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► Analytics).

So large screens are coming but operators will need to bear in mind that sizes at the lower end of the range will be common in the short term. The key from a content perspective is immersion. The larger the screen, the more immersive the experience, which in turn becomes a service differentiator. As with HD, the introduction of UHD capabilities will encourage content producers to explore new and better ways of telling stories.

“Stop thinking full screen mode,” is Heimbecher’s blunt assessment. “With a display as big as 105

inches, you can show several feeds in parallel or use part of the screen for ancillary information. In other words, UHD shouldn’t just be thought of as bloated HD.”

Drama from Netflix (House of Cards), HBO (Game of Thrones) and AMC (Breaking Bad) is already created with the big screen in mind for an immersive, cinematographic experience.

ALL ABOUT IMMERSION

Carving out portions of the larger screen will also enable sports production to evolve towards wider shots

and fewer pan and scans. Perhaps the key application here is multiscreen production, as larger screens will allow for a combination of full- or half-pitch shots alongside close-ups and information boards.

It is an approach already pioneered by Sky, Canal+ and other operators for Champions League football and Formula 1 but it can be expected to become a standard part of the live UHD experience.

“If the bottom half of the 4K screen is a panoramic view of the whole stadium, and on top are two HD images, one of, say, the player with the ball, and the other of the fans making a nuisance of themselves, it really makes a great total experience,” says Wood. “On the other hand, I haven’t seen any other kind of material apart from stadium sports events that look that good in multiscreen.”

Four live games shown ►►

“THE LARGE SCREEN COULD BECOME THE HOME MULTIVIEWER OR MINI MASTER CONTROL ROOM, ALLOWING VIEWERS TO VIEW A PROGRAMME WHILE SURFING FOR OTHER CONTENT”



Netflix, which is already streaming in 4K ▲

BATTLE FOR THE BIG SCREEN

“A SYMPATHETIC INTEGRATION OF SMART HOME FUNCTIONS INTO THE STB AND OTHER DEVICES IS A VALUABLE SERVICE THAT OPERATORS CAN MONETIZE”

▶ simultaneously on 1920x1080p quadrants (equivalent to 4 x 42-inch HD TVs) might be another compelling service on, say, UEFA Champions League match nights or on the final day of the league season, allowing an armchair viewer to keep track of action in real-time.

360-degree cameras can provide a panoramic stadium seat view (as trialled by FIFA during the Brazil World Cup). Statistics feeds and highlights reels or specialist camera angles for slow-motion or player-cams could be added to the service package and fan experience. Other ideas include object-oriented soundtracks where the viewer might select audio feeds that situate them as if in a stadium or pub with friends. This interactivity is coming from Dolby.

“Larger displays could be flexible enough to offer multiple windows, including video, information screen,



Alex Fishman, NAGRA UEX Studio ▲

social media, communications and so on,” says Mercer. “Platform owners should ensure that consumers have as much choice and flexibility as possible around these options.”

A Skype chat with friends could be facilitated side by side with a live broadcast or a recorded programme, enticing viewers to engage more with the large screen, rather than down at their laps.

“A UHD augmented user interface (UI) can incorporate features that have simply been impossible before, such as a wide range of social-TV applications,” says Alex Fishman, Director of User Experience at NAGRA UEX Studio, a team of experts covering graphic and interface designers and application engineers. NAGRA’s ‘Buzz’ app permits social media feeds from Twitter, for example, to be combined with content shown on the main screen so that users might, for example, be able to chat with friends while watching the same movie or live event, and it also aids in the discovery of content through a ‘What’s Trending’ content recommendation.

“The large screen could become the home multiviewer or ‘mini MCR’ [Master Control Room] allowing viewers to view the main programme while surfing for other content - either linear or OTT,” suggests Cristina Garcés, Managing Partner, Optiva Media, adding that in-built apps will reduce the need for external plug-ins, and therefore for stand-alone devices such as Apple TV or Roku. Optiva Media is a consulting and solutions engineering company focused in the digital TV market.



Cristina Garcés, Optiva Media ▲

Sarah Pearson, Managing Partner at the audience behaviour research firm ACB suggests that commercials should be designed to indulge the viewer “with super-creative experiences that can support the explosion of 4K/Ultra HD in consumers’ conversations.”

She further warns that more research is needed into several areas of the UHD TV user experience. For example, Game of Thrones producer HBO “may prefer not to spend \$8 million an episode to have overlays or permanent interfaces of other content masking it or competing for eyeballs,” she says. “But they may like to have their content in a slim box to the right hand side of the EPG warning the viewer to their new series, promoting their app or cueing up viewing in time for the appointment-to-view programme. The viewer might find this helpful, with promos more engaging, but of course this will need further research.”

SMART HOME, SMART TV

Outside of the immediate ▶▶

BATTLE FOR THE BIG SCREEN

▶▶ programme/VOD content universe, Pay TV providers are spying the larger screen real-estate as a platform to integrate Smart Home services. Sales of wearables or sensor laden devices like smartwatches (Pebble), glasses (Epson Moverio) and bracelets (Nike FuelBand) are predicted to be worth \$30 billion by 2018 (IHS), while more sensors are being embedded in home hardware and cars for the purposes of infotainment, navigation, diagnostics and so on.

The real opportunity comes when data gathered by these devices is shared machine to machine and connected to personal devices, often at a very granular level, forming ever larger data sets (the Internet of Things).

“A sympathetic integration of Smart Home functions into the STB and other devices is a valuable service which MSO/MVPDs can monetize and use to reduce churn,” suggests Mee. “Many users will want their Pay TV service to be one (albeit sometimes the central one) of many home automation devices, and we see most value in providing TV-centric functions from the STB.”

Examples might include pausing DVR playback to show the user who has just pressed the front door bell; Skype chat, babycams and

home controls for heating and lighting. “The user should always be given the choice of attending to these and other functions on the TV or on their smart phone,” adds Mee.

An elegant dashboard on the large screen might seem the ideal hub for an ecosystem of connected devices.

“In one scenario, you come home and the TV is already active in the background processing the information from Nest temperature controls and your own personal activity,” describes Fishman. “The TV knows you are in the house and offers up home automation or CCTV controls. The TV screen is the centrepiece of the main room in the house. Operators are definitely looking at opportunities to sell around this.”

Indeed, such functions are already coming to retail. At CES 2014 Samsung demonstrated an application of its Smart Home operating

systems in which a voice command of ‘goodnight’ spoken via the TV remote control would turn off the TV and the lights. A ‘Movie Mode’ dims the lights and turns up the volume for a cinematic effect. LG’s version of in-home connectivity, Home Chat, offers users the chance to communicate with appliances via

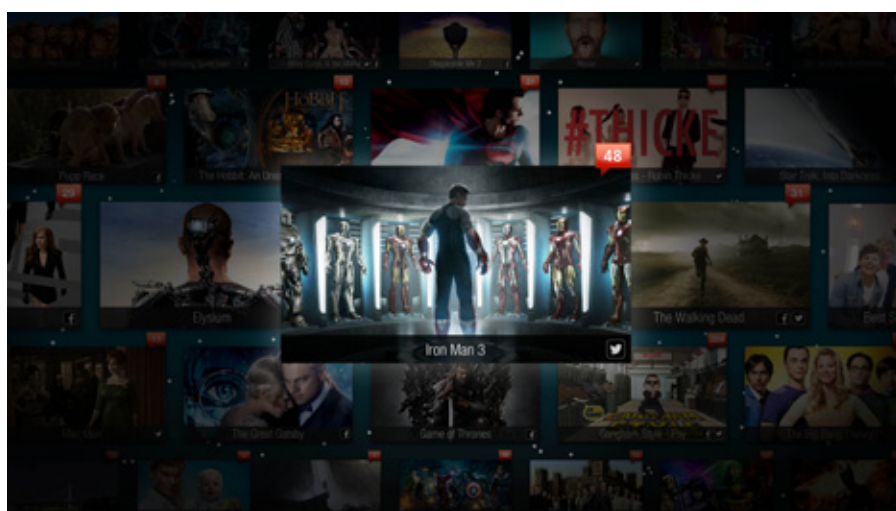
“BANNER ADS AND PROMOTIONS
COULD BE DISPLAYED ON A PORTION
OF THE SCREEN BUT IN A WAY THAT IS
NON-INTRUSIVE TO THE ENJOYMENT OF
THE MAIN CONTENT”

text messaging.

Further out, users of fitness bands could have their data thrown to the large screen and synced with relevant workout videos or dietary advice. Wearable camera systems (such as Neurowear) might record an event, a day, a life, and automatically create highlight reels cataloging entire personal experiences. These memories may eventually be stored in the cloud but what better place to review them than on the giant screen?

Monetizing this potential, and also decisions on who offers the service, are the vital take-away questions. “Certainly an operator could offer a service to support this on their gateway and STB solutions connected to the TV,” says Fishman. There is clearly a lot left to explore in this area.

“Part of me hopes that the age of the Internet of Things will mean that humans don’t have to bother with mundane activity, and that the machine to machine dialogue takes care of it for you,” says Wood. “Humans just have to sit back and watch great TV shows,” he says. “At least I am hoping that it will be that way.” ▶▶



Social buzz drives discovery (NAGRA UEX studio, Project Ultra) ▲

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Sample UI as developed by Optiva Media ▲

SECTION 3: UI DESIGN, UEX, NAVIGATION AND CONTROL

- ▶ Amid all the opportunities afforded by larger screens with increased pixel densities, it should not be forgotten that the killer application is still television.

“The bigger the screen, the more emotionally powerful the experience,” says Fishman. Indeed, the combination is seen at the very least as maintaining consumer appetite for watching content on the main screen, if not actually diverting attention back from second screens.

“The large screen should be acting as a hub for all content in the home,” he says. “For example, pictures taken on smartphones are often at 4K resolution or higher and they

“UHD SCREEN CLARITY OFFERS THE FREEDOM TO CREATE FAR MORE VISUAL INTERFACES, MAKING TEXT-BASED EPGS A THING OF THE PAST”

deserve to be displayed on the best possible screen. An Instagram app on a UHD TV would deliver an emotional response that would attract people back to the large screen.”

Interface designers must, however, resist the urge to fill the increased screen real estate with all manner of tickers, pop-ups and streams except where the user consciously chooses to integrate this information into their TV viewing experience. This philosophy is central to the exploration of next-gen UI at NAGRA UEX Studio.

“The UHD UI and UEX is not just about rescaling HD and tidying up tired old SD or HD interfaces, EPGs and pop-ups,” stresses Fishman. “It is about looking at the UHD screen real estate, the resolution and big-screen format in a different way, in order to create a complementary

and visually stunning ‘wow factor’ that goes beyond UHD video.”

UI designers need to be careful not to irritate the viewer with overlays of content or options on the side of a screen. Pearson at ACB comments: “It would be a dynamic that consumers would find disruptive. Viewers are unlikely to want to give up any screen real estate for anything other than the programme unless it was integral to the content.”

Ironically, the sheer amount of material available to satisfy viewing needs and desires makes monetizing it far from straightforward. The key lies in simplifying the discovery process. If the UI is inefficient, the risk is that viewers will be overwhelmed by the quantity of content.

“A well designed UI captivates users,” NAGRA’s Fishman says. “Optimized design also increases ▶▶

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► monetization opportunities, driving users to purchase content and increase media consumption.”

What’s more, banner ads and promotions could be displayed on a portion of the screen but in a way that is non-intrusive to the enjoyment of the main content.

“The user experience will change dramatically with 4K, as bigger screens with more pixels create more opportunities for an improved UI,” says Pascal Portelli, SVP, Solution Strategy & Portfolio Management, Connected Home at Technicolor, the gateway, STB and connected home solutions provider. “However, it’s essential that it remains simple from the users’ standpoint – we want to hide the complexity.”

UHD screen clarity offers the freedom to create far more visual interfaces, making text-based EPGs a thing of the past. 720p artwork and graphics makes visual navigation crisp, clear and straightforward. Up to ten thumbnails of VOD movie options could be rendered on a single page. The viewer simply ‘reads’ the



A Samsung 105-inch curved UHD TV ▲

picture.

The need to collate relevant content from multiple sources for individual users must also be addressed in such a way that media curation becomes vital to content discovery. It is another key tenet of the UEX Studio team’s model UI for 4K TV, dubbed Gravity Ultra.

According to Fishman, “Experience has shown that content needs to be delivered in a customized way to every user, otherwise it will simply sit there, stale, and users will feel that there is nothing to watch. There is a huge opportunity for service providers to harness relationships with their customers through a smart interface and curated services, to get to know them better and to be able to

target them with streams of tailored content that is relevant and accessible.”

Another challenge is that the same content needs to be displayed on very different devices – from large-screen TVs down to smart phones – and users may benefit from a common user experience across all these devices. Many existing UIs are unable to offer similar experiences across different devices, thereby complicating the experience for the user.

Managing the interplay between multiple devices is one of the biggest challenges facing operators, says Fishman. Users who experience inconsistent usage across devices will finally look for alternative content ►►



Andy Mee, EchoStar ▲

“SOME WILL PREFER INTERACTIVITY TO TAKE PLACE ON THE MAIN SCREEN; OTHERS WILL OPT FOR A SECOND SCREEN APPROACH OR EVEN BOTH”

BATTLE FOR THE BIG SCREEN

► sources, especially on portable devices, eroding the value of a service provider's brand.

WHERE DOES CONTROL LIE?

The jury is still out on whether voice control, gesture, second screen or traditional remote control is the best means of interacting with the giant screen. Voice recognition engines are

be difficult, as this will tend to be different for different viewers," says Heimbecher at Sky Deutschland. "Some will prefer interactivity to take place on the main screen, others will opt for a second screen approach or even both.

One suggestion is to enable users to interact more naturally with the screen by mimicking the way that people organize and interact

interface representation.

COMMAND AND CONTROL

Even three clicks to what you want to find is too many for a simple control function. "Voice is probably the way to go but speech recognition engines are some way from primetime," says Fishman.

Project Ultra is being fitted with an evolved voice input so that the response is immediate. "The system has to be 'listening' in the background to react with intelligence," says Fishman. "Any solution must be simple and elegant."

Since all UHD TVs and set-top boxes will be connected the possibilities are endless. There is no reason why providers couldn't offer information and control displays alongside video, but not everyone is convinced that the big screen is best placed in this scenario.

Strategy Analytics research suggests that the preferred location for such content is a personal device while DisplaySearch narrows this down to the smart phone.

"The centre of people's lives is their mobile phone," argues Gray. "It's personalised whereas the TV is a shared screen. However, the gateway function is potentially valuable if it removes complexity – but above all it needs to play nicely with the phone. The watchword here is painless. If it's easier to channel it all through the STB, then fine. The problem I anticipate is that the phone is updated every two years or so; will the STB be able to keep up?"

Given a typical TV's lifetime of 6-8 years this would take it out of the running, but not necessarily the STB, provided operators can update it regularly with new features and functionality. That's where a configurable UEX comes in. ►

"LOGICALLY THE UI LAYOUT SHOULD BE VIRTUALISED BACK INTO THE CLOUD, WITH SIMPLE RENDERING OCCURRING ON THE LOCAL DEVICE"

improving but not perfect, and it may be that we do not want to talk to our telly. Gesture-based interaction using infrared technologies like Kinect have been tried, but arm movements can be tiring when most people want to relax.

"Interaction with a screen that you cannot touch is inherently difficult, especially if you are reclined with a drink in your hand," observes Gray.

DisplaySource agrees that the value proposition for UHD TV remains the sharing of passive entertainment. Its research on app usage shows that consumers gravitate to long-form video on the TV.

"We will see increasing abstraction of the UI to tablets and smartphones – indeed putting a touch screen in the palm of the hand transforms the possibilities," says Gray. "However, it goes back to the need to play nicely. Pay TV operators are in a far better position here than CE brands, which come far more into conflict with supporting competitor products."

Finding the right balance between passivity and interactivity will

with objects in the real world. Gravity Ultra achieves this with a zoomable user interface (ZUI). Instead of traditional time-oriented grid guides, the ZUI offers fully rendered three-dimensional spaces, similar to those of videogames, to offer engaging navigation and new kinds of



Jack Wetherill, Futuresource ▲

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Sky Deutschland tests UHD at the DFB-Pokal Final ▲

photo: Skysampics

CONFIGURABLE UEX

- ▶ The biggest challenge for CE kit manufacturers is to deliver interfaces which look and feel as slick as those found on current generation gaming consoles, while using a processor with a fraction of the power. “Consumers are going to be unforgiving of poor quality user interfaces,” says Mee at EchoStar. “Historically CE vendors have relied on carefully optimised embedded native UIs to overcome this problem, but this scales poorly with increasing UI complexity and real estate.”

Facing strong competition from pure OTT players who can innovate far more quickly over the network, Pay TV operators need to be empowered with the ability to react.

“The sheer diversity of devices that video is getting delivered to means it is becoming cost prohibitive to constantly add features and therefore reduces the service velocity,” says Fishman. “Logically the UI layout should be virtualised back into the cloud, with simple rendering occurring on the local device.”

The advantage is much greater agility to add new features. Rather than embed code and test it on an

array of devices, a cloud server environment allows an operator to adapt quickly to new types of display.

The home hardware is still challenged, though, in pushing greater pixel volumes around on screen, especially at higher frame rates. For a rich UHD UEX, graphics need rendering at full UHD 4K60p, which very few current UHD TVs support. This will come with new silicon and in particular could be provided by adding a set-top box to purchased 4K screen TVs.

NAGRA UI/UEX Managed

Service is offered as a partnership with operators in the design and ongoing operation of the UI to deliver on the rich UEX that consumers will find compelling in a service proposition. It is a multi-year service taking the client from design of an original UI and managing its evolution over time, addressing compatibility and updates in the service, seamlessly, for any new devices.

“Outsourcing allows timely, relevant skills to support the

broadcaster when necessary, and to enhance or replace internal resources,” says Garcés (Optiva Media). “External resource providers usually have more experience from different projects and are up-to-date and fresh in thinking.”

SECTION 4: INTEGRATING UHD INTO THE TELEVISION ECOSYSTEM

The advent of UHD represents a significant risk to rights owners due to content being made available in a high-quality format close to that of the master. No surprise then that the industry has been vocal about the need for content protection, especially given the experience with HD rollout a decade ago.

“Studios lost control of HD content distribution to piracy in a way that had a critical impact on revenue,” says Christopher Schouten,

“THE MOVIELABS SPEC IS MORE OF A LIST OF INGREDIENTS THAN A RECIPE”

Senior Director Product Marketing, NAGRA. “The move to UHD is a chance to reset the bar and to reset it higher.”

“Hollywood studios are demanding higher security than ever before in order to protect UHD content,” underlines EchoStar’s Mee. “Security and potential loss of revenue should be taken extremely seriously.”

The imperative is clear in the best-practices document for content ▶▶



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Stephan Heimbecher, Sky Deutschland ▲

► protection published by MovieLabs, the R&D consortium comprising six Hollywood majors.

MovieLabs' charter is to lead the evaluation, introduction and development of key distribution and usage technologies that may be critical to the studios and the broader media market. The imminent transition to UHD means a specification that demands a tougher stance on content protection has been pushed high up the agenda. Broadly, there is a strengthening of the core protection mechanism [HDCP] with a revised approach that is more robust. In addition, content forensics have been added to enable rights breaches to be investigated.

"The spec is more of a list of ingredients than a recipe," describes André Roy, Head of Security Practice at the consulting firm Farncombe. "It clearly states a number of mechanisms but it is up to each studio to define which requirements they want to enforce, then up to the licensees to implement them."

From a technical perspective

"WATERMARKING IS AIMED AT BETTER DETECTION AND MANAGEMENT OF CONTENT PIRACY AND IS ANOTHER SIGNAL OF INTENT FROM MOVIELABS"

the securing of the video path with hardware security jumps out. "A number of software-only implementations today carry HD content but MovieLabs spells out a hardware-enforced system and is a clear indicator that studios are more intent on seeing an increase in the level of device robustness over that of HD," explains Roy.

This hardware root of trust requires a series of unique keys that are personalised into the silicon of the decoder chip. There is also provision to frustrate hackers by preventing repeat breaches using the same method of attack working multiple times.

"The spec demands a unique hardware ID and to uniquely tie a security claim to that hardware, so if you swap the hardware out of that box it won't work in another," explains Schouten. "This is reinforced by title diversity ensuring that a hack of a DRM scheme that works with one piece of content won't necessarily work on another."

Component technologies that are currently considered safe from hacks include standard AES

encryption with a minimum key length of 128, and version 2.2 or higher of the HDCP scheme for protecting links such as HDMI cables. The requirement for HDCP 2.2 is not only being applied to UHD but other high value content such as early release windows or same-as-theatrical content.

From a governance perspective, MovieLabs defines third-party certification and proactive monitoring by the licensee and it demands that security be highly renewable. "If there's any issue with a single asset the security piece can be renewed such that it won't affect other pieces of content," says Schouten.

Most critical is the requirement to embed forensic watermarks in the content with information about the device or user who requested it.

"Watermarking is aimed at better detection and management of content piracy and is another signal of intent from MovieLabs to look for a more managed ecosystem than a simple, deployed client," says Roy. "With VOD and OTT, the content will ►►



Storage, as enabled by Harmonic's MediaGrid, will be impacted by UHD ▲



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David Watkins, Strategy Analytics ▲

▶▶ be unique streams so the reference mark is inserted when requested from the client in a compressed domain." Discussions are needed as to how such session-based watermarking will be inserted at the network edge.

Given that feature film and drama content is the prime concern of the consortia, MovieLabs' 4K content protection statements to date concentrate on VOD. Some of its members though (Disney with ESPN; Fox with Fox Sports), will be keen to extend the specs into the live domain while affiliate members, such as BSkyB, have a strong interest in live 4K content protection being firmed up.

There are challenges, though. While Pay TV broadcasters have traditionally used single security schemes to scramble and encrypt all the content, MovieLabs would require individual encryption per channel and per device.

If watermarking ends up being a fixed requirement for 4K live, Pay TV operators will need to take

“THE BOTTOM LINE IS THAT THE MOVIELABS SECURITY REQUIREMENTS ARE AN ORDER OF MAGNITUDE MORE COMPLEX THAN THOSE IN USE TODAY”

account of this early in their 4K STB design process. “It’s likely that the watermarking solution will be at least partly at the silicon level incorporated in new 4K STBs,” says Schouten.

While widely welcomed and understood, the broader spec is not without issue in regards to implementation, complexity and cost. Ultimately it is operators who will carry the cost, although what that cost will be is still unknown.

“The new hardware environment adds complexity to the solution, which adds cost either directly or in the time [needed] to implement, or both,” says Roy. “Items like watermarking have a performance impact which needs consideration.”

The bottom line is that the security requirements are an order of magnitude more complex than those in use today. Says Schouten: “It will require new technology, but also the managed implementation of the specifications from extremely trusted and well known vendors to the Hollywood community.”

NAGRA believes it is setting a new security benchmark itself. At IBC2014 it will present new smart card technology called NAGRA any-CAST Command. For the first time this will make it possible not only for all the decryption but all the descrambling that used to be the preserve of the STB to be performed on the chip.

“This is a secure end-to-end media pipeline all the way from head-end to home display and the most advanced code execution environment that exceeds all existing and

emerging industry standards,” says Schouten.

IN HOME REDISTRIBUTION

There is an argument that UHD prolongs the need for on premises hardware. Without the new silicon and prescription for hardware encryption, the set-top box may have been relegated to the cloud sooner rather than later. Instead satellite operators such as BSkyB are developing STBs with Ultra HD chipsets aware that the economics of large scale delivery, for live sport in particular, are weighted in favour of DTH and against bandwidth-hungry OTT.

One question raised by the introduction of UHD is how it impacts in-home redistribution, given that today broadcast services are sometimes redistributed on the home network for use on secondary STBs and ▶▶



Christopher Schouten, NAGRA ▲

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Sarah Pearson, ACB ▲

▶ multiscreen devices (sometimes with transcoding). And what does it mean for more simple operations like picture-in-picture?

Suitable silicon is emerging for mass production of UHD-capable boxes; the only caveat is that in the short term it is not possible to decode multiple UHD services simultaneously on a single piece of silicon.

“At this time the cost-effective way of delivering functions such as picture-in-picture and transcoding for delivery to mobiles is to rely on HD simulcasts and simultaneous recording, rather than attempting to decode multiple UHD sources,” says Mee.

“We need to recognise the way people actually go out and buy TVs,” urges Portelli. “They may have the newest, most up to date technology in the living room, but the rest of the house might be in HD, or even standard definition. Therefore, there has to be a way to make sure the experience is good across all the different sorts of TVs and devices in the home. The STB connected to the 4K TV needs

“OVER TIME DISTRIBUTION WILL INEVITABLY SHIFT FROM THE PRIMARY UHD TV TO THE SUPPORT OF MULTIPLE UHD DEVICES IN THE HOME”

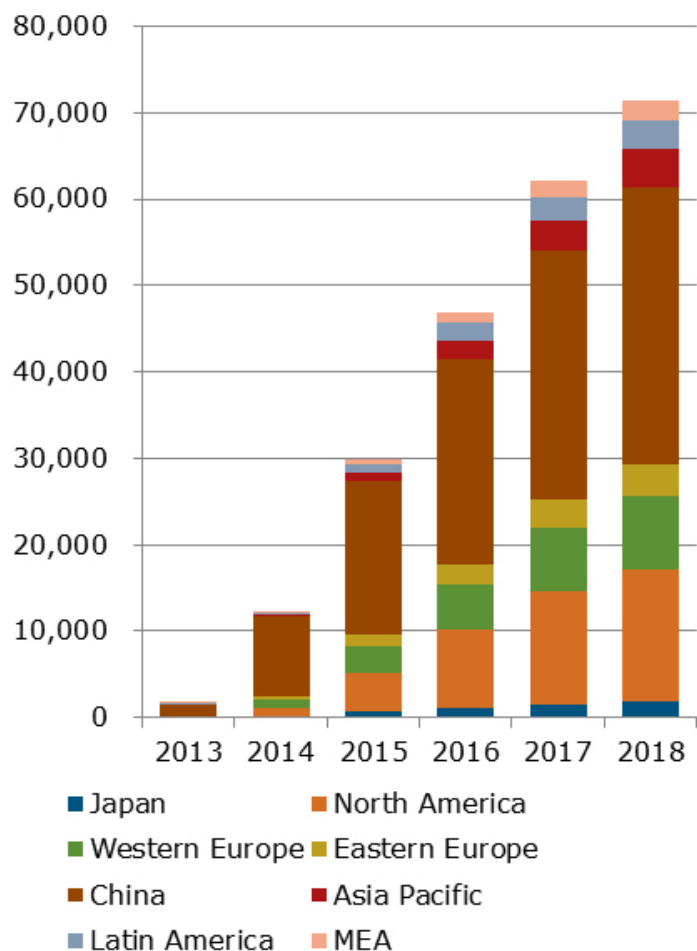
to be able to record and play 4K in the main room, but also downscale in other rooms.”

While HEVC compression is a key enabler, delivery into the home is pretty much unaltered, arriving as traditional MPEG transport or with adapted bitrate for OTT.

“There’s still quite a way to go and HEVC is more challenging to work with but we’re close to having a fully rounded ecosystem,” says Portelli. Technicolor already has a major customer in Tata Sky in India which is performing a full 4K STB implementation.

“There are three areas to be addressed,” according to Portelli. “Next-gen chipsets need greater processing power and more memory; a new generation of HDMI connectors need to be introduced; and an improved UI must enhance the experience for consumers. We’ll see big steps being made into early 2015, and momentum around HDR [High Dynamic Range] in particular.”

Initial UHD deployment will be for VOD and high-value broadcast content targeted at the first screen but over time distribution will inevitably shift from the primary ▶▶



4K TV shipment forecast from NPD DisplaySearch ▲



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- ▶▶ UHD TV to the support of multiple UHD devices in the home.

“There should be no real challenge for in-home UHD DVR and pushing to other devices,” says Schouten. “For delivery via the cloud, UHD represents the addition of intermediate profiles up from 1080p 60 to 4K, so this becomes very transparent to the existing system. If we then want to move UHD around, the bandwidth required of wired [G.Hn/Moca/HomePlug] connectivity is in place to handle that today while Wi-Fi technology is evolving inside the home.” For a quality 4K experience, Wi-Fi home networks will need to support at least 25Mbps per stream.

“Whether to use embedded or virtualised UI functionality – or a combination thereof – is a choice made by the TV operators themselves, and it depends on what will best serve the needs of the consumer,” says Portelli. “For example, there are some situations where it will make more sense to use embedded UI for reasons of bandwidth, and others



The Joint EBU-DVB Workshop on High Dynamic Range in June 2014 ▲

“THE ONLY PLANS THAT SET MAKERS HAVE TOLD US ABOUT ARE FOR MAKING 2160P TV SETS, SO WE REALLY HAVE NOTHING TO GO ON REGARDING 4320P SETS”

where the enhanced processing power of the newest generation of STBs running UHD and 4K can be used to do a lot more than simply play and record content, such as generate UI and handle gaming.”

TOWARDS PHASE 3 UHD

Propelled by a legacy of HD to UHD innovation and the prospect of the Tokyo Olympics in 2020 as a showcase for its emergence from economic stagnation, Japan alone is pursuing an 8K broadcasting vision.

Technically the 8K 120p system could be applied to 4K 120p broadcasts – something still at the edge of current 4K production and distribution technology elsewhere and seen as necessary for live sports broadcasts. SHV’s image sensor has 33-megapixels and the pixel count can be downsized/down-converted in a signal processor.

NHK, however, is resolutely focussed on launching its 8K service directly without taking what Senior Manager, Narichika Hamaguchi, describes as “a roundabout course.”

NHK’s past predictions, such as 3DTV broadcasting being fashion only, have a habit of coming true, so we can’t dismiss their view, observes EBU’s Wood: “But infrastructure changes of the kind needed to move to 4320p have also traditionally taken much longer than we think. The only plans that set makers have told us about are for making 2160p (4K, phase 1) TV sets, so we really have nothing to go on regarding 4320p sets. We have no solid basis for working on a broadcast standard.”

Even without the highly ambitious 8K systems, there is a long road ahead for UHD and much to think about, with pixel count being just the starting point. ■



David Wood, EBU Technical ▲

ENTERTAINMENT PROTECTED



BEST CONTENT PROTECTION TECHNOLOGY
NAGRA ANYCAST PRM



NAGRA'S OVERARCHING SECURITY PHILOSOPHY OF MEDIA RISK MANAGEMENT HIGHLIGHTS A NEW APPROACH IN ADDRESSING THE SECURITY REQUIREMENTS OF SERVICE PROVIDERS BASED ON THE NOTION THAT NO TWO SERVICE PROVIDERS ARE ALIKE AND ALL HAVE DIFFERENT RISK FACTORS. IT BRINGS TOGETHER NAGRA'S EXPERTISE IN CONTENT PROTECTION AND KUDELSKI SECURITY'S LEADING CYBERSECURITY AND ANTI-PIRACY SERVICES.

At IBC, NAGRA will present NAGRA anyCAST, the company's next-generation Security Services Platform that allows any service provider to protect the delivery of any content over any network to any device. Additionally there will be a demonstration of the DISH Anywhere App for iPad protected by studio-endorsed NAGRA anyCAST PRM. Kudelski Security will also demonstrate its anti-piracy and cybersecurity services and present the latest information on piracy trends.

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