THE NEXT REVOLUTION IN THE TV WORLD?

ULTRA HIGH DEFINITION

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EUTELSAT SPOTLIGHT
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Ultra High Definition, What for?

The digital revolution which is impacting the cinema industry began by a format known as 2K, and is continuing with 4K for very large screens. In parallel, many leading filmmakers recommend using a “high frame rate” (HFR) by increasing the image frequency from 24 to 48 and possibly even 60 frames per second (fps), to improve visual comfort when viewing high-velocity shooting.

Television has itself witnessed many revolutions in just a few years, from black & white to colour, analogue to digital, standard definition (SD) to high definition (HD) and from heavy and bulky cathode ray tubes to compact and much lighter plasma, LCD or LED flat screens. Not forgetting the advent of trans-national digital TV via satellite and the related explosion in the number of channels carried.

In terms of technical quality, HD TV is close to 2K cinema, but if cinema theatres increasingly offer 4K images on very large screens, viewers will soon want the same thing at home (larger pictures, very high resolution, excellent rendering of colours, doubling of the image frequency, immersive viewing).

As technological progress enables manufacturers to offer screens that get lighter, thinner and better year by year, at affordable costs, the trend is obviously to have the slimmest screen possible at home, and to hang it on the wall, or to replace it by a state-of-the-art projector. In terms of image resolution, HD will become insufficient on large screens, and this is where Ultra High Definition (UHD) will come into its own.

With respect to events, where Eutelsat has played a pioneer role in Europe, live retransmission of cultural, artistic or sports events to cinema theatres is currently carried out in HD, comparable to 2K cinema. To avoid disappointing viewers, who will become accustomed to 4K quality in feature films, such retransmissions will have to move into Ultra HD. Even though Ultra HD is a disruptive technology, obliging TV channels and studios to invest heavily in new equipment, there is no doubt that its advent is just round the corner.

Eutelsat believes strongly in the future of Ultra HD, and its satellites are ready to carry it, initially in the form of thematic channels using play-out (cinema, documentaries...) as well as for live retransmission of major events to cinema theatres.
4K: already in the movie theatres, facilitated by satellite infrastructure

To understand how 4K images will revolutionize the TV viewing experience, we must effectively refer to 4K in the Digital cinema world. Although Digital Cinema differs slightly from TV (a 4K cinema frame has 4096 pixels per line compared to 3840 for 4K TV), “more films than ever are post-produced in 4K, either based on 35mm negative film or digital 4K shoots, which will now be made available to cinemas in 4K”, says Oliver Pasch, Head of European Digital Cinema Sales at Sony Professional. All Hollywood studios are already embracing 4K as the ultimate theatrical presentation format, making eight-megapixel 4K images the next big thing in cinema. Recent examples include The Dark Knight Rises, Men in Black III, Spiderman 4 and Samsara.
“More films than ever are post-produced in 4K”

Oliver Pasch
Head of European Digital Cinema Sales,
Sony Professional
Warner Bros. has released this summer The Dark Knight Rises in 4K. Taking the movie experience way beyond High Definition (2K) resolution, screenings in Sony Digital Cinema 4K-equipped theatres have been widely acclaimed for their ground-breaking visuals and special effects that are considered as some of the best ever seen on screen.

Men in Black III, originally shot in 2D and later converted to 3D using a 4K Digital Cinema projection technology, has offered an immersive visual experience allowing viewers to get incredible detail and clarity, something which is absolutely essential for this action-packed blockbuster.

Samsara’s “emotional impact” was due to a film shot entirely in 70mm, and presented in 4K digital projection to allow for mesmerizing images of unprecedented clarity.

The Digital Cinema Initiatives (DCI) specifications, which are used by Hollywood, feature a maximum of 250 Mbits/sec for a JPEG2000 compressed 4K image, though this is set to double to 500 Mbits/sec in the next five years or so.

“In DCI terms, at the highest bit rate of 250 Mbit/sec, a two-hour 4k film would be 225GB for the image only, excluding audio or sub pictures,” says Oliver Pasch who underlines the fact that while there is a tendency to compress as much as possible to reduce file sizes, studios and distributors will increasingly consider sending 4K films to cinemas via satellite rather than physically on hard disks.

Men in Black III, originally shot in 2D and later converted to 3D using a 4K Digital Cinema projection technology, has offered an immersive visual experience.

Photo by Antonio Mo.
A new immersive viewing experience: it is not just one more thing!

All those having had the chance to view 4K TV images on 4K TV sets agree that the images look incredible. The TV image, four times the resolution of Full HD, creates a brand new immersive viewing experience. And this undeniably impressive experience is boosted by the sound genuinely coming at you from every angle, like the very best cinema.
To appreciate the difference with Full HD, 50-inch TV sets or more are ideal but the UHD difference can be seen on anything from a 40-inch display upward. According to researchers, while viewers may initially think that even higher resolutions would result in larger screens in already cramped living rooms, that is not the case. Higher resolutions could bring a more immersive experience to the home theater as viewers enjoy a wider field of view watching 4K video.

The simple way to understand this is to think of today’s personal computer monitors where the viewing distance is typically 18- to 24-inches for a 27-inch, 1080p monitor. If the resolution of that monitor is set at 640-by-480 pixels (standard definition TV resolution), the picture is not very sharp or pleasing. On the other hand, the picture looks fantastic if the resolution is set at 1920-by-1080 (2K) pixels.

This concept applies to television and theatres as well. Consumers should be able to sit close to a 4K television enjoying a wider field of view and a more immersive experience.

The recommended viewing distances shown in the diagram below are based on the picture resolution and the height (H) of the picture. With several 4K movies in production, a content evolution has begun. “This new model redefines what consumers should expect from their television’s performance,” said Brian Siegel, vice president of Sony Electronics’ TV Group. “Our professional division continues to see the migration toward 4K content creation with major film and broadcast productions.”

Incorporating proprietary up-scaling technology, the new TV sets will be able to ensure that every frame offers 4K resolution regardless of the content source, delivering a viewing experience that exceeds Full HD resolution.

Brian Siegel
Vice President of Sony Electronics’ TV Group

“This new model redefines what consumers should expect from their television’s performance”
Ultra HD and 3D: the finishing stroke?

Some may think UHD is the new hype that could compete with 3D. We don’t think so. Both will complement and even boost each other in the future.
It is true to say that 3D has not met the great expectations of the consumer electronics industry. 3D TV sets are now no more expensive than 2D sets, and compared to HDTV in the first year of its availability, 3DTV sets sold almost five-and-a-half times as fast. But the 3D revolution was just not happening. The real issue from the consumer side is not (only) the shortage of 3D content, but the fact that people hate wearing 3D glasses. Progress towards glasses-free 3D TV may now signal the start of 3D as mainstream.

Earlier in 2012, Toshiba launched the first consumer 55 inch glasses-free 3D TV while major manufacturers such as Sony, Samsung, LG or JVC have also presented their models at various trade shows during 2012. To create the glasses-free 3D effect (also known as autostereoscopic) without forcing the viewer to keep his head very still, an integrated camera(s) feature(s) face-tracking technology, which monitors the viewers’ position and directs the different images for their left and right eyes in real time. Thus creating the illusion of three-dimensional depth when watching 3D television programmes or Blu-ray disks.

TV manufacturers clearly believe that 4K is a worthy upgrade over a Full HD set, to watch glasses-free 3D content. If 4K content has not yet reached the market, 4K 3D TV sets will in the meantime upscale HD contents [such as HD broadcasts and Blu-ray movies] to image quality “beyond Full HD 1080p resolution”, while 2D content can also be up-converted to 3D.

According to Roland Vlaicu from Dolby Laboratories “Manufacturers will need to be convinced of user cases that support the need for a 4k panel in the home, which could well be higher-resolution 3D using passive glasses or even glasses-free 3D.”

While 3D glasses-free TV are selling with a price tag of 8,000 Euros, more models can be expected to reach the market soon at lower prices.

→ Roland Vlaicu
Dolby Laboratories

“Manufacturers will need to be convinced of user cases that support the need for a 4k panel in the home, which could well be higher-resolution 3D using passive glasses or even glasses-free 3D”
The technical UHD challenges

To assess the length of time UHDTV would take reach the market, we must distinguish 4K vs 8K as well as mass-market adoption vs early adopters targeted niches. Some observers comment that HD has taken more than 20 years to reach the mass-market. Other experts estimate that we won’t see the first 8K TV until 2020 and it won’t be mainstream until 2025.

Olympic Games 2012
During the London Olympics this summer, some viewers around the world got a glimpse of television’s next vision. Britain’s BBC displayed 8K coverage on 15-meter display screens around London to show some games on similar big screens.

Photo by S. Pytul
All this may be true for 8K, despite the fact that NHK has begun forecasting a market introduction for the 2016 Olympic Games.

But let’s focus our analysis on the commercial introduction of 4K TV, to raise the attention of TV stakeholders for their short to medium term planning exercise. Market barriers are more driven by contents and costs issues than by technical issues. By the end of 2015 there should be a technical 4K offer available for consumers with 4K TV sets and 4K Set Top Boxes (STBs - consumer receivers).

To bring quality UHD video-streaming contents to the home, the new HEVC (High Efficiency Video Coding) compression standard should allow a significantly lower bit rate than the current prevailing codecs (e.g. H.264 / MPEG-4 AVC), which suggests that these services will not become a “bandwidth killer”. The upcoming HEVC video compression standard seems to be one of the key elements towards a wide deployment of 4K and 8K resolutions.

By 2015, DTH operators could also benefit from DVB-S3, a new broadcast modulation standard, which would normally coincide with the availability of STBs with HEVC chipsets operating up to 60 fps (frames per second). All these add-on technologies may represent significant improvements for reducing the transmission bandwidth and support the image quality delivery.

Even if 2013 witnesses the arrival on the market of Blu-ray players with a 4k upscaler, there is currently no activity within the Blu-ray Disc Association (BDA) to bring 4K into the Blu-ray specifications. An increase in the capacity of optical discs would be required with the current compression standard to store a typical film at UHDTV resolution, but the implementation of HEVC coding could make the 50 GB capacity of a Blu-ray disk sufficient to store a 4k movie.

Hard disk storage is a key component in a Personal Video Recorder (PVR), to allow the consumer to record digital television programming for subsequent viewing. For typical consumer use, a capacity corresponding to about 20 to 40 hours of programming is probably required, regardless of whether the content is SDTV, HDTV or UHDTV. Current hard disk technologies are already capable of meeting the requirements of UHDTV recording and playback in a PVR.

But considering the size of UHD video files, we should see more and more a push for the Network PVR (nPVR), where recordings will then be held on a hard drive in the cloud, enabling lower cost STBs.
Main market drivers

According to In-Stat* “the first UHD broadcasts will start around 2017 with UHD TVs reaching about 5% household penetration in some regional markets in the early 2020s”. Korea has plans in place to begin test broadcasts in 2013.

*Consultancy

"We always get this question when we launch beautiful new technology: Where’s the content?"

Phil Molyneux
Chief Operating Officer
Sony Electronics

Market driving forces will be subject to the “chicken and egg” syndrome: not enough content, not enough viewers, too expensive TV products and vice versa!

Phil Molyneux, said the situation was no different from the launch of the cassette tape, the CD or the DVD. “We always get this question when we launch beautiful new technology; Where’s the content?” Molyneux told journalists at an event in New York. “Did we bring the content to market? Yes, we did.”

So the question is how and when the virtuous circle will accelerate thanks to a true 4K content offer. Because 4K 3D TV sets, currently selling for 8,000 euros, should still be premium products in 2017 (over 2,000 euros) the first public demand will come from premium consumer market segments, and at this horizon a potential transition might begin to occur. As was the case for HD and 3D TV sets which are now mainstream, a small amount of 4K content isn’t going to stop people buying 4K 3D sets as they’ll be able to upscale content to 4K while they’re waiting for true 4K content to become available.

But there won’t be a mass upgrading of TV’s to start with, as the first products will be large screens with 50/60 frames per second to fully benefit from the total 4K potential, with computer graphics requirements beyond the reach of the mass market.

Although many consumers are more than happy with 1080P, and the current quality of Blu-ray, the good news however is the shorter life of plasmas and LCDs. It took quite a while for LCD and plasma prices to drop when they were introduced and replaced the old school CRT. But now consumers no longer want to hang on for 10 or more years to benefit from the last TV technology and TV manufacturers clearly position UHD as the next good opportunity for the replacement of existing TV sets.
4K contents roadmap

We anticipate the first commercial offers coming with UHD TV channels from PayTV operators focusing on cinema production and documentary programmes, which are now increasingly produced and post produced in 4K for movie theatres.

As of 2015, movies should be the key drivers of UHD adoption. Combined with 3D this will contribute to fight off the OTT threat. Churn reduction and customer “stickiness” are the name of the game for Pay TV platforms as opposed to growth in direct revenues. The most competitive pay-TV markets can be expected to move first (US, UK, followed by France, Italy, Germany).

Sports channels will follow rapidly, possibly to be ready with commercial offers for the 2016 Rio de Janeiro Olympics. From Day One, Eutelsat will be able to offer the necessary bandwidth to bring incredible quality images in any home worldwide, making “UHD for everyone” an Olympic Games reality. This will force the broadcasters to prepare themselves with new outdoor production equipment, new cameras, mixers, special effects…

Studios will be the last to switch, probably after 2020, as they have to amortize their existing HD investments.

FIFA World Cup
In 2010, more than 250 hours of 3D transmissions were routed via Eutelsat satellites for the FIFA World Cup™. This experience will contribute to Eutelsat’s readiness for UHD TV.
Since 2008, Eutelsat has been broadcasting live in High Definition a range of leading cultural and sports events to cinema audiences throughout Europe. Rock concerts, rugby, football and basketball championships, opera and ballet performances by the MET in New York, the Bolchoi theatre in Moscow and the Paris Opera have all generated enthusiastic responses from the public and demonstrated that a real market exists for alternative Out-of-Home HD transmissions on large screens, offering exceptional video and audio quality. The experience gained by Eutelsat with such broadcasts will be of great assistance in the transition to Ultra HD, where vastly enhanced picture quality can be expected to draw even greater audiences.

Photo by Nisian Hughes
From Day One Eutelsat will broadcast incredible quality images bringing UHD to homes

Undoubtedly, satellite will be a key actor of the UHD TV success, as its transponders are already UHD TV compatible.
For Eutelsat this is not a new story. At the 2008 IBC in Amsterdam, Eutelsat, a partner of the “Broadcast Technology Futures Group”, received the “IBC 2008 Special Award” for the first worldwide Super Hi-Vision satellite 8K transmission.

Satellite has many competitive advantages over other communications infrastructure like cable, DSL and DTT. Optical fiber may be a good competitor in developed countries but unfortunately the governments and Telcos are not in a great hurry to invest in the FTTH infrastructures. While fiber IPTV to the home will remain marginal, from Day One Eutelsat will be able to offer the necessary bandwidth to bring images of amazing quality to any home in its coverages, making "UHD for everyone" a reality.

With the new HEVC and probably the DVB-S3 standards, we should be able to transmit around 5 UHD 4K channels at 50 fps per 36MHz transponder, with a bit rate per channel a little higher than one current MPEG4 HDTV channel, but with a double frame rate (50 fps instead of 25) for a better viewing experience.
“We believe that UHDTV could be the next battleground between satellite and cable, and that it will be a key competitive issue in the latter half of the current decade.”

Sarah Simon
Senior Analyst, Berenberg Bank
SatMagazine.com – September 2012

Documentaries
Many nature documentaries use timelapse and slow-motion to capture breathtaking scenes of the nature in exquisite 4K.

Photo by Brian Stevenson
I’ve personally seen the pictures with the UHDTV system, and it’s absolutely stunning — the sense of being there is superb

François Rancy
Director of the ITU’s Radiocommunication Bureau
during the announcement of the ITU Recommendations on UHDTV standards
(Geneva, 24 May 2012)

Photo by Eric Isselee
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