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The Technology Update from DVB

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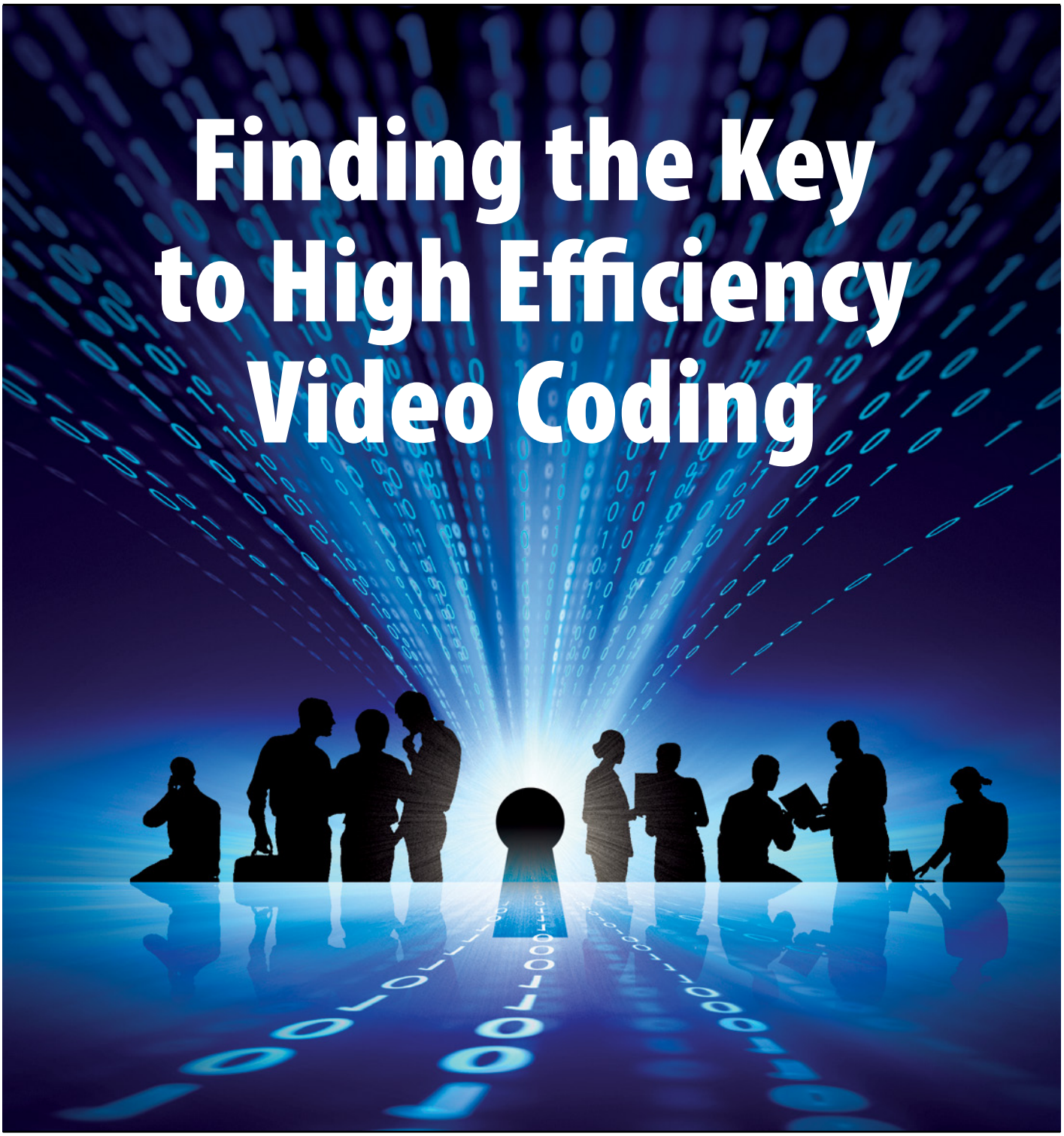
Finding the Key to High Efficiency Video Coding



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I AM ENDLESS
POSSIBILITIES
AND THE SATISFACTION OF EFFORTLESSLY BRINGING
ALL YOUR HOME ENTERTAINMENT TO YOUR TV
I AM INTERNET
ON YOUR TV
AND THE JOY OF VIEWING THOUSANDS OF VIDEOS
WHILE CHATTING
WITH FRIENDS ON YOUR FAVOURITE SOCIAL NETWORK
I AM WIRELESSLY
CONNECTED
TO YOUR PC AND YOUR MOBILE
AS YOU SHOW OFF YOUR FAMILY PHOTOS
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ENTERTAINMENT
TECHNOLOGY USER-FRIENDLY AND EASY TO DEPLOY
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Outstanding Achievement

A Word From The DVB Project Office

Peter Siebert
Executive Director

As I write these lines, I am more than pleasantly surprised by the success of DVB-T2. After the successful rollout in the UK, Sweden has now officially launched its own DVB-T2 HD services. These will be soon followed by Finland. Outside of Europe, Sri Lanka will leapfrog to DVB-T2 and other countries like India and Kenya have released tenders for their T2 networks.

As Executive Director of the DVB Project Office , I am proud of these achievements with DVB-T2, which follows the success of DVB-S2, which in Europe alone covers 10 million households. Furthermore, there is also a lot of market interest in DVB-C2, which strongly indicates that our latest cable standard will be as successful as its elder siblings. The overwhelming market acceptance of our second generation standards leads us to ask what will come next? It seems as though there is always something coming up over the horizon and requiring new specifications. What could it be this time? In this issue of DVB Scene you can read that a new video coding standard is on its way. Like its predecessor H.264, it will increase the video coding efficiency again by a factor of two. For DVB, H.264 was the basis for high definition. Let's see what High Efficiency Video Coding, or as it is known in its abbreviated form HEVC, will bring to DVB. Integrating the new video coding standard into the DVB specifications is just one example of the upcoming activities in DVB. We will continue to be the place for innovation and development of standards in the broadcast domain.

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New Standards

TS 102 772 Ver. 1.1.1: Specification of Multi-Protocol Encapsulation - inter-burst Forward Error Correction (MPE-iFEC) (01/09/10)
TS 102 992 Ver. 1.1.1: Structure and modulation of optional transmitter signatures (T2-TX-SIG) for use with the DVB-T2 second generation digital terrestrial television broadcasting system (01/09/10)
TS 102 831 Ver. 1.1.1: Implementation guidelines for a second generation digital terrestrial television broadcasting system (DVB-T2) (DVB-T2 Implementation guidelines)(08/10/10)

New Members

Institut National des Sciences Appliquées de Rennes (INSA)(Academic Partner) - One of a network of five elite public sector engineering schools in France. **www.insa-rennes.fr**

Funke Digital TV - Develops, produces and markets digital reception antenna solutions. **www.funke.nl**

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Not Only For Broadcast

Finding other uses for DVB standards

Christophe Trolet

Christophe Trolet,
Head of TeamCast Solutions

Christophe Trolet, an electronic engineering graduate from Polytech Nantes (France) joined TeamCast in 2003 as leader of advanced solutions for DTT and mobile TV. In 2010 he became head of the newly formed TeamCast Solutions (for wireless transmission technologies and Test & Measurement). TeamCast Solutions provides suitable technologies for added dimensions in digital broadcast applications around the world.

Since 1993, the DVB organization has developed digital broadcast standards for the different broadcast platforms - terrestrial, satellite and cable.

Within the membership of DVB, the professionals in the broadcast sector have the opportunity to exchange their experiences in the field together with practical problems encountered in particular environments. This sharing of experience enables the best technology solutions to be selected to form efficient digital broadcast standards. In this way, DVB-C and DVB-S became the reference standards for cable and satellite broadcasting, and DVB-T was established as the reference for terrestrial. The evolution of technology and electronic integration however, has allowed the further development of these standards, resulting in the second generation versions: DVB-C2; DVB-S2; DVB-T2.

Although these standards are used mainly for cable, satellite and terrestrial broadcasts, they possess characteristics which can be exploited by other applications – in particular, in the area of audio and video wireless transmission for Electronic News Gathering (ENG). Certain existing digital standards are therefore able to support the bitrates required by this service and provide reliable quality at speeds of up to several hundreds of kilometers per hour and in hostile and noisy environments.

Historically, wireless transmission for ENG was first digitized in the early 2000s using the DVB-T standard as the basis. This digital terrestrial broadcast standard, thanks to its resilience to echoes, at this time made these types of links significantly more reliable and revolutionized the domain. As the technology developed, DVB-T receivers with 'maximum ratio combining' (MRC) diversity inputs were put on the market, catering for 2, 4 and 6 receiving antennas. These products pushed the limits of the state of the art in terms of mobility performance and improved reliability for the links. Thanks to the gains provided in this way by the antenna diversity, the transmission constraints could be overcome and this enabled the bitrate used by vehicles for ENG systems to be increased. This increase in payload capacity coupled with the associated gain in performance and the progress in the development of H.264 coding technologies, has also allowed high definition to be used in these applications. Today, of course, sports events are mainly produced in high definition (Formula 1 racing, football matches, etc.) and in the domain of ENG, one cannot imagine using analog systems anymore!

In the same way, other digital standards developed for broadcasting have their own individual features, and can equally establish themselves in the area of wireless transmission. One could for example employ aspects of the DVB-S2 transmission standard to establish a high bitrate wireless link between two mobile terminals, if certain conditions were respected.

It must be noted that if digitization is already well advanced in the ENG applications mentioned here, a good number of other areas, such as security, defence, surveillance (of goods and people), telemetry, etc., remain today as potential customers for digital solutions with high capacity, which are reliable and robust even when mobile.

Using the standards defined by DVB is a card that has yet to be played in the competition for these new sectors in the marketplace. If digital modulation is well adapted to exploit the market for mobile wireless transmission, it is important to make the selection between a single carrier modulation like DVB-S2, a multi-carrier modulation like DVB-T with its different characteristics, and upcoming applications with LTE and NGH technologies. In this way, we can see that DVB standards are not only for broadcast!

Rotated Constellations

A new diversity technique for DVB-T2

Catherine Douillard

There is an easy way to identify a DVB-T2 transmitted signal. Just have a look at the transmitted constellation and observe that, unlike other DVB standards using Quadrature Amplitude Modulation (QAM), this constellation is rotated. Rotated constellations have become a kind of trademark for DVB-T2.

What is the purpose of this new feature?

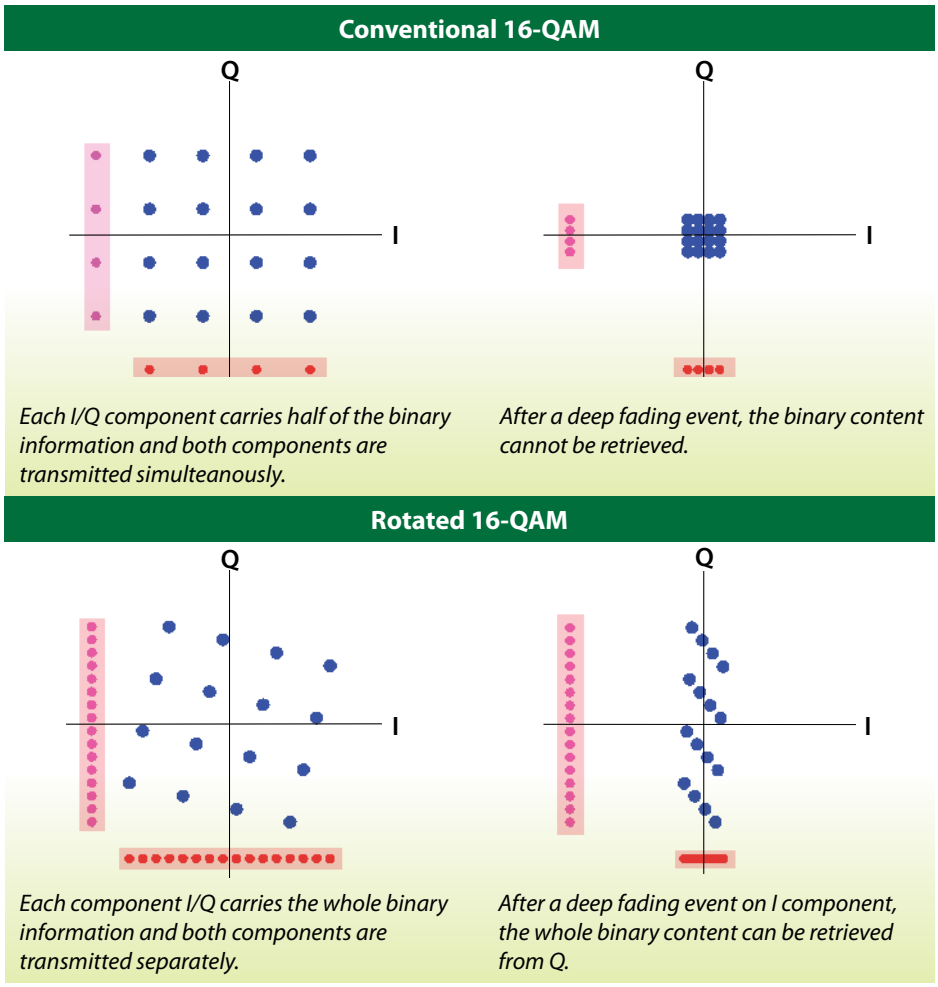
It is actually a spectrally efficient diversity technique which has existed since 1997 but had no practical applications until DVB-T2. It is intended for fighting against severe fading by transmitting two copies of the message under different channel conditions. The most widespread diversity techniques are: time diversity (e.g. adding redundancy with an error correcting code and spreading it in time with interleaving), frequency diversity (e.g. OFDM modulation in combination with subcarrier interleaving) and spatial diversity (e.g. Multi-antenna or MIMO systems).

Rotated constellations call for yet another type of diversity, called signal space diversity. When using conventional QAM constellations, each signal component, in-phase (I) or quadrature (Q), carries half of the binary information held in the signal. Thus, when a constellation signal is subject to a fading event, I and Q components fade identically. In the case of severe fading, the information transmitted on I and Q components suffers an irreversible loss. The very simple underlying idea in signal space diversity involves transmitting the whole binary content of each constellation signal twice and separately yet without loss of spectral efficiency.

How does it work?

First, thanks to the constellation rotation, components I and Q both carry the whole binary content of the signal. In fact, every point in the constellation now has its own projections over the I component and the Q component. Next, the two copies or projections of the signal are sent separately in two different time periods or two different OFDM subcarriers, or two different antennas, in order to benefit from time or frequency or antenna diversity respectively. Thus, when a transmitted component I or Q of a rotated QAM symbol is deeply faded or erased, the binary information carried by the whole QAM symbol can nevertheless be retrieved thanks to the remaining corresponding component. The principle of signal space diversity is illustrated in Figure 1 for a 16-QAM constellation.

Fig. 1 - Effect of rotated constellations on transmissions with deep fading events



With the diminishing availability of spectrum resources, the Single Frequency Network (SFN) has become a desirable topology for broadcasting systems. In an SFN, several antennas transmit the same bit stream information at the same frequency, creating multiple echoes of the same signal. This generates self-interference and leads to severe fading and even erasure events, for instance when two echoes are received with comparable power levels. The consequence is then a loss of several decibels in error correcting performance, the only possible counteraction being the use of low Forward Error Correction (FEC) coding rates, thus sacrificing part of the benefit of SFN in terms of spectral efficiency. However, thanks to rotated constellations, this detrimental effect of SFN can be mitigated, leading to a lower performance penalty.

Actually, the performance improvement due to rotated QAM constellations gets larger with respect to classical QAM constellation schemes when the erasure ratio increases, in other words with worsening channel conditions. Despite a lower gain for large constellations, this technique is still attractive for high throughput broadcasting services like DVB-T2, thanks to its performance benefit at high coding rates. Moreover, its suitability to small constellations makes it an excellent candidate for low throughput mobile scenarios as encountered in the upcoming DVB-NGH standard.

Catherine Douillard,
Professor, Electronics Department,
Telecom Bretagne

DVB-S2 at the Core

All IP networking concept for the exchange of multimedia content

Simon Pryor

Simon Pryor
Product Marketing Manager,
Broadband Systems, Newtec

Multimedia Exchange Network over Satellite (MENOS) is an all-IP networking concept for the exchange of multimedia content over satellite, using the features of the DVB-S2 standard. Primarily for professional broadcasters, MENOS allows them to exchange video and audio material among several sites over long distances. In particular, MENOS is used for broadcast contribution – getting material for television and radio programmes from a remote location to the studio or production center – and for the exchange of broadcast-ready material between geographically remote locations.

MENOS is currently being deployed by the Arab States Broadcasting Union (ASBU) as the main broadcast infrastructure across the entire Middle East and North Africa regions. In terms of audience size and geographical reach, this makes MENOS the largest broadcast contribution and exchange system based on DVB-S2.

The advent of DVB-S2 has brought many advantages for broadcast contribution. More stringent roll-off factors, more efficient modulation and coding (MODCODs) and Variable Coding and Modulation (VCM) to allow multiple and varying MODCODs within a carrier, allow the more efficient use of satellite bandwidth resources.

The most important advance is the native support for IP. It allows more efficient encapsulation and enables contribution using an all-IP transport, which has considerable benefits for broadcasters. ASI cabling and broadcast equipment can be replaced by the more cost effective ICT switches, and IP routing used for telecommunications and internet access. The broadcast industry is also in the process of converging with the IP world in pursuit of more efficient file-based production workflows. Therefore, contribution of material for broadcast in the IP domain makes good sense.

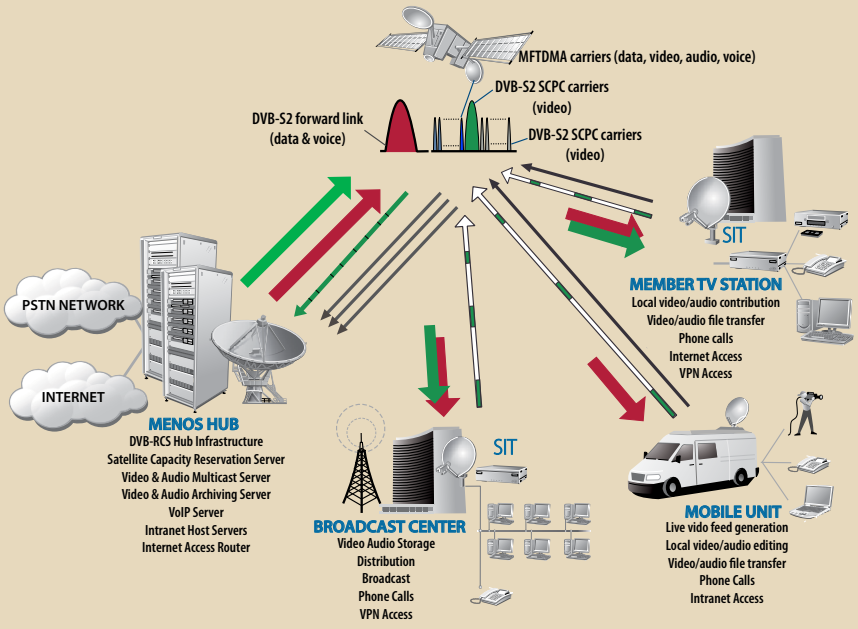
However, MENOS is not just a platform for transporting audio and video to the production center and around the broadcaster's footprint: it also includes other services which make broadcast operations over satellite easier and more efficient. These include VoIP, file transfer, IP access for session booking and automation. With access to these services, journalists and cameramen are no longer reliant on separate telephone services and networks when operating in the field.

The DVB-S2 specification includes support for Constant Coding and Modulation (CCM), VCM, and Adaptive Coding and Modulation (ACM). VCM and ACM offer many advantages, but for broadcast audio and video contribution VCM is preferred over ACM to ensure the quality of the contribution stream. So for the contribution, VCM is used for a managed SCPC (Single Channel Per Carrier) service and bandwidth efficiency is optimized through a technology called LinkFlex, which calculates the optimal MODCOD configuration in the given set of conditions. Centrally located stations with high gain, can for example, be served using less satellite bandwidth by selecting a more efficient MODCOD. LinkFlex assists the allocation on a session by session basis, but once allocated, changes are not made during a session. During each session the system measures performance at the terminals to monitor the capabilities of the transmitting and receiving stations, and LinkFlex can make optimizations based on that analysis.

To enable the additional services, MENOS includes multiple transport systems. An always-on MF-TDMA layer gives the remote terminals access to VoIP, file transfer, IP session booking and so on. In the multiplexed service the VCM component delivering the contribution or distribution always takes priority, and the bitrate for concurrent best-effort IP traffic is dropped if the link quality deteriorates.

MENOS incorporates many of the key advances of DVB-S2 into one network, delivering optimizations that make media operations over satellite more efficient and cost effective. Satellite broadcast operations previously relied on separate networks for TV, radio, and communications between broadcast staff. MENOS merges all these activities into one network, to create a multiservice platform with IP as the enabling core technology.

The MENOS Reference Architecture

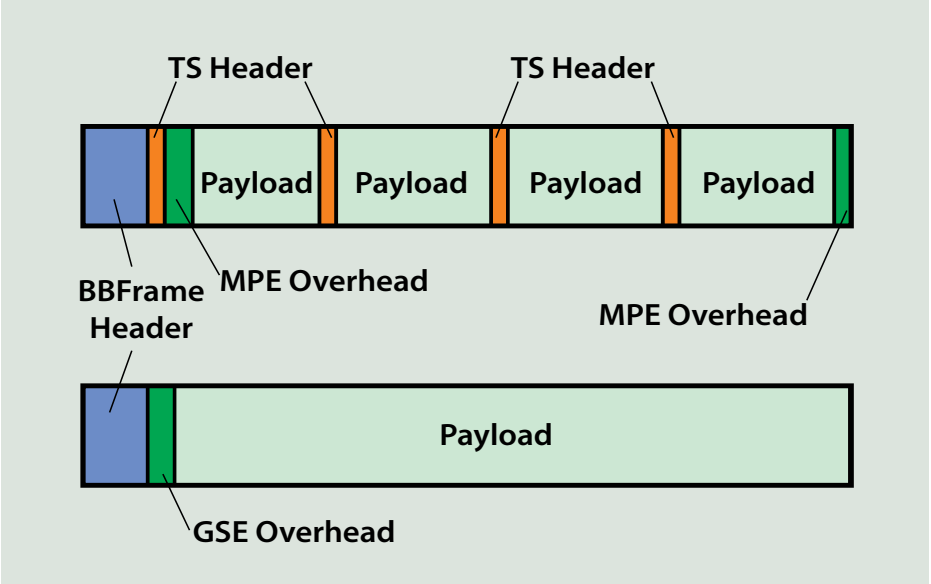


IP over DVB-x2

Transmitting IP data with the generic stream capability of the second generation DVB standards

Jörg Rockstroh, Senior R&D Engineer, WORK Microwave GmbH

Whereas DVB-T2 services have been launched in 2010 and DVB-C2 services are expected in 2011, DVB-S2 services have already been widely deployed. A major step in this evolution has been the capability to go beyond the well known MPEG transport stream (TS) as system layer. Traditionally designed for video and audio transportation its purpose has been extended to content delivery with an entirely different requirement profile: IP network traffic. Multiprotocol encapsulation (MPE) was defined to accomplish this task, but the difference of the combined data types had two obvious disadvantages - a complex encapsulation process and a significant amount of overhead. In order to improve these two points the second generation DVB standards introduce generic stream encapsulation (GSE), where IP data is packed directly to baseband frames and the transport stream layer becomes obsolete.



While the complexity of the encapsulation process is mostly a developer's concern, wasted bandwidth is a commercial issue for all participants in a data communication service. Typical numbers for overhead estimation mention 10 to 15 percent for MPE compared with 2 to 3 percent for GSE. To go a step further than typical statistical values, the following example will show where this overhead has its origin. If a 1000 byte IP packet is encapsulated with both methods, the MPE packet is spread out over 6 transport stream packets (1041 bytes without padding -1128 bytes overall), while GSE adds only a header of 10 bytes with the MAC address as a major part of it. This difference increases for smaller IP packets as the MPE protocol offset in a single TS packet is at least 21 bytes.

With such a saving in bandwidth usage, an immediate market acceptance could have been expected, especially as DVB-S2 is a technology that is operated globally. Yet surprisingly, since its introduction in 2007, GSE has had a slow start. One potential reason, probably common for all new technology steps, might be the concern about backwards compatibility and integration into existing systems, although GSE and transport streams can easily be combined in a DVB-S2 transmission using the MATYPE header fields. In this multi-stream mode it is even possible to forward the input stream identifier (ISI) of the GSE stream within the transport stream signalling. Perhaps it has to become more evident that the ISI now replaces the PID (Packet IDentifier) as the relevant number to indicate a service in a transmission.

At a glance, GSE as a modern encapsulation technique fits seamlessly into both new and existing transmission links, but in practice, there are two points that have been identified that have room for improvement. Firstly, the TS 102 606 specification lacks the definition of a signalling mechanism that respectively offers the possibility to generate a separate transport stream to forward information to the receivers. Manufacturers have rejected this obvious step backwards and implemented different proprietary solutions. This might lead to degradation in interoperability, although not all link types need forward signalling.

The second point addresses the fact that a baseband frame, after forward error correction, does not necessarily have to be completely error free. Occasionally, one or a few erroneous bits could have been left by the FEC under certain circumstances. A transport stream payload would have a CRC8 over each packet in place of the sync byte during transmission, plus each encapsulated MPE frame has its own CRC32. In GSE, a checksum is only required for partitioned GSE frames to ensure that parts from several DVB-S2 baseband frames are recombined accordingly during reception. Regular GSE frames, in most cases the major part, are left untouched. With the ongoing work on a new DVB-RCS specification, which will be capable of handling generic streams like all second generation standards, the DVB TM-RCS Group outlined a proposal to fill this gap. Hence a backwards compatible extension can be expected soon.

Despite these two minor points of concern, GSE is a significant step forward in building IP networks over satellite. While practically all new links are using DVB-S2 instead of DVB-S, the encapsulation technique is often stuck in the late 1990s. Significant progress has been made by manufacturers during last year to introduce an increasing number of GSE devices onto the market. Therefore, it is now up to the link operators to have the confidence to change over to the new technology and in turn maximise the efficiency of their IP networks.

Tomorrow's World

High Efficiency Video Coding: the Future of Video Compression?

Ken McCann, Chairman TM-AVC

Ken McCann is a director and co-founder of ZetaCast, an independent technology consultancy company specializing in digital TV and related areas.

The current generation of video compression technology (H.264/AVC) provides about a factor of two improvement in compression efficiency compared to the previous generation (MPEG-2). This ability to get the same quality of video at half the bitrate has provided an important technology enabler for the growing number of high definition (HD) television services that we see today. However, the development of the next generation video compression standard is already starting to take shape. This promises to deliver another factor of two improvement, providing a further boost to the number of HD services that can be transmitted and potentially paving the way to new ultra high definition (UHD) services.

This new video compression standard, known as High Efficiency Video Coding (HEVC), is being jointly created by ISO/IEC MPEG and ITU-T VCEG, the same two standardization bodies whose previous collaboration resulted in both MPEG-2 and H.264/AVC. A wide range of video resolutions will be covered, from low resolution right up to the UHD resolutions of 4K x 2K and 8K x 4K.

Call for Proposals

The first step towards creating HEVC was the launch of a joint Call for Proposals in January 2010. A total of 27 proposals were received – quite an impressive response, given the amount of work that was required to prepare a proposal. Each proposal was tested using 18 video sequences, 5 bitrates and 2 constraint sets. The 18 sequences covered five classes of video resolution, ranging from quarter WVGA up to 4K x 2K. The 5 bitrates were chosen to provide a range of video qualities from highly stressed to good quality encoding. For example, the 1080p 50 and 60 Hz sequences were tested at bitrates ranging from 2 to 10 Mbit/s. Given the target of a factor of two increase in coding efficiency, this roughly corresponds to the quality of a current H.264/AVC encoder operating at 4 to 20 Mbit/s. Two constraint sets were defined for the encoding - the first, typical of broadcasting applications with limits to the time for a channel change, the second, typical of conversational services with limited encode/decode delay.

Two different types of quality measurements were performed, using a standard software implementation of H.264/AVC as a lower anchor. Firstly, objective measurements were made using the Peak Signal-to-Noise Ratio (PSNR), i.e. the ratio between the energy in the encode/decode error and the energy in the original picture. PSNR is a commonly used and convenient method of giving an approximate indication of the likely video quality. However, despite many years of trying to come up with an accurate objective measurement, the only way to really determine video quality remains the rather awkward and expensive process of running subjective tests with real people.

Formal subjective testing was therefore carried out for all test cases, apart from the two UHD sequences. Around 23,000 video clips were tested; this appears to be the largest subjective quality testing effort ever carried out in the history of video compression. The test was organized in 134 sessions of approximately 20 minutes each, using a total of 850 test subjects over a one month period. This was really too much for any single laboratory to cope with, so the burden of testing is being shared between three sites: FUB in Rome, EBU in Geneva and EPFL in Lausanne.

Results of HEVC Call for Proposals

The technical details and results of the HEVC Call for Proposals were analyzed during the first meeting of the new Joint Collaborative Team on Video Coding (JCT-VC) in April 2010. The basic architecture for all of the proposed algorithms was a hybrid motion-compensated block transform, the same basic architecture used by MPEG-2 and H.264/AVC. Within this traditional architecture many innovative new tools were proposed, with larger block sizes and a

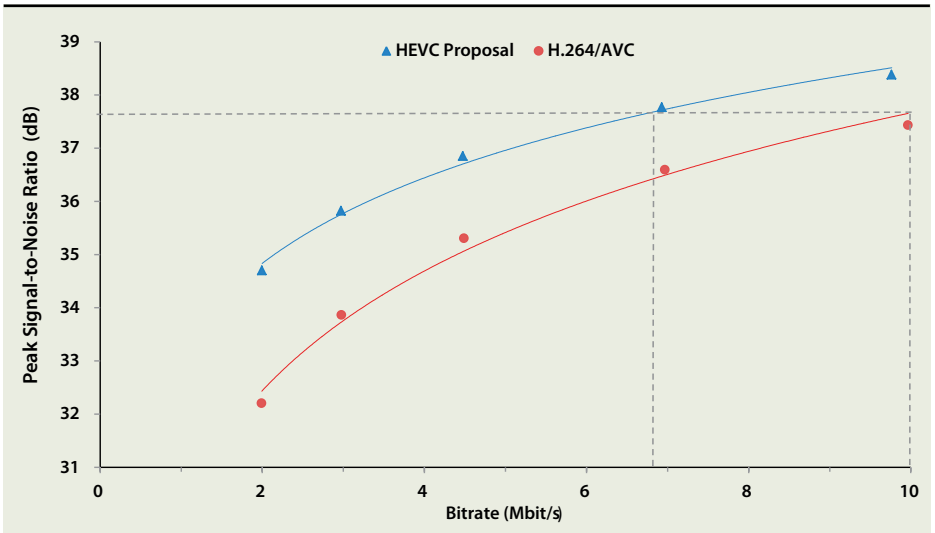


Fig. 1 - 1080p 60Hz sequence "BasketballDrive" encoded at bitrates of 2, 3, 4.5, 7 and 10 Mbit/s. Reproduced with the kind permission of Samsung Electronics Co. Ltd.

more flexible block structure being common themes.

The test results were very encouraging, both using objective and subjective measures. The graph in Figure 1 shows a typical example of an objective rate distortion curve, using results obtained from the individual proposal that gave the best overall results. This example is a 1080p 60Hz sequence "BasketballDrive" encoded at bitrates of 2, 3, 4.5, 7 and 10 Mbit/s using the encoding constraints typical of broadcasting applications. The red dots represent the results obtained using a software model of H.264/AVC, the blue triangles represent the results from the proposal. The vertical axis is PSNR, with a higher number indicating better results.

At 10 Mbit/s, the H.264/AVC software gives a PSNR value of about 37.6 dB. The same PSNR is obtained by the proposal at approximately 6.6 Mbit/s – about 34 percent less. The bitrate saving increases to about 48 percent if the same analysis is done when H.264/AVC is operating at 5 Mbit/s. This pattern is fairly typical: a significant bitrate saving for good quality video which increases further if the comparison is done at a lower quality point. Figure 2 shows the percentage bitrate savings implied by the objective measures for all five 1080p sequences, averaged across the five test points. The overall average bitrate reduction is 43 percent.

However, what really matters is the bitrate reduction at the same subjective video quality, which is shown in Figure 3 for the same five 1080p sequences. Based on these subjective results, the overall average bitrate reduction was 61 percent. As with the objective measures, the savings are largest at the lowest bitrates – if we were to focus purely on the results at bitrates that gave broadcast quality video then the average bitrate savings from the proposal would be closer to 50 percent.

Sequence	Bitrate Reduction (%)	Average (%)
Kimono	44	43
ParkScene	33	
Cactus	41	
BasketballDrive	44	
BQTerrace	54	

Fig. 2 - Bitrate Reduction implied by PSNR Measurements

Sequence	Bitrate Reduction (%)	Average (%)
Kimono	60	61
ParkScene	60	
Cactus	57	
BasketballDrive	57	
BQTerrace	70	

Fig. 3 -Bitrate Reduction implied by Subjective Results

These results relate to only one of the 27 proposals; several other proposals also performed well. At its April meeting, JCT-VC decided not to adopt a "winner takes all" approach and instead defined a "Test Model under Consideration", which combined specific elements from seven of the leading proposals.

The first formal HEVC test model, "HM1", was defined in October 2010. This was largely a selection of the better-performing tools from the "Test Model under Consideration", following a detailed analysis of their individual contributions. HM1 will be used as the basis of further "Core Experiments" and the HM can be expected to evolve through several versions before the standard is completed. Throughout this process it is anticipated that there will be further incremental improvements to the compression performance.

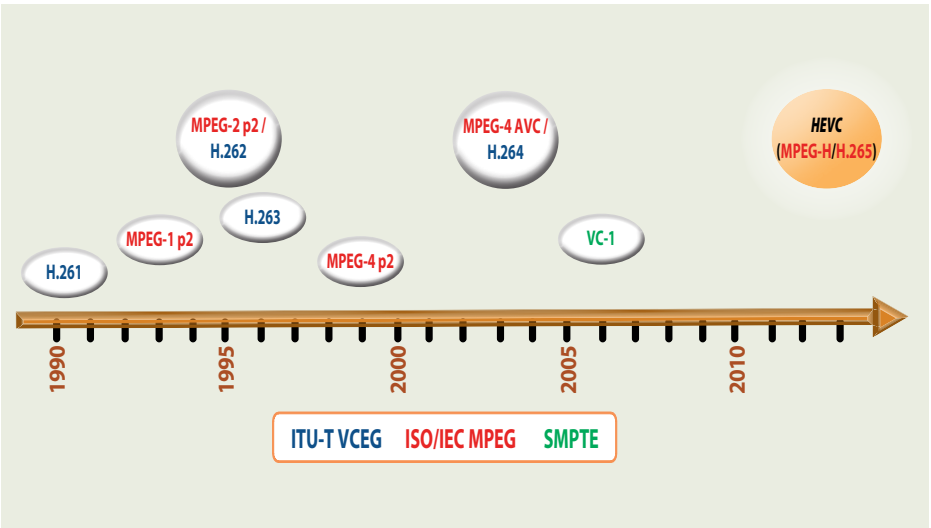


Fig. 4 - Codec Timeline

The plan is to complete the new HEVC standard by January 2013. It is then intended to be published by ISO/IEC as MPEG-H and by ITU-T as H.265.

Will the HEVC standard be a success in the market?

Before looking at the future, it's often instructive to consider the past. Figure 4 shows the major video compression standards that have been developed over the past 20 years. Two of these have been particularly significant: MPEG-2, the standard that launched the digital broadcasting revolution, and H.264/AVC, which has had such a large influence since its creation that it has been difficult for alternatives to grow in its shadow. It is interesting to note that, like HEVC, both of these standards were the result of collaboration between MPEG and VCEG.

So how will HEVC fare? In general, we can observe that improvements in video compression come in two forms. Firstly, there is a gradual evolution of encoders giving greater efficiency within a specification, where existing decoders can continue to be used. Secondly, there are occasional moments when there is a revolution caused by a change of algorithm, where new decoders are needed. It seems that the market is prepared to consider such a revolutionary change of algorithm roughly once a decade, provided that it can be justified by about a factor of two improvement in coding efficiency.

So HEVC appears to have it about right in terms of both timing and functionality. If history repeats itself, we might expect to see publication of HEVC in 2013, addition to DVB in 2014 and services ready to launch in 2015, perhaps with Ultra HD as a pioneer launch service. Watch this space!

Winning Combinations

DVB-CSA3 + DVB-T2/C2/S2: The clever choice

Bertrand Wendling, Director of Standards and Regulatory Affairs, Nagravision

Over the last few years, DVB has developed a new generation of its technologies. As a result, adequate coherence of the overall end-to-end system is essential. With the introduction of a new technology gap requiring new components and devices for the introduction of DVB-T2, DVB-S2, DVB-C2 or HD services in SD networks, one clever choice would be to switch from DVB-CSA to DVB-CSA3. Of course, the use of DVB-CSA3 with the launch of DVB-T/S/C in new digital markets will also be the best future proof decision.

DVB-CSA (Common Scrambling Algorithm) is a mathematical cryptographic method used to encrypt video streams. It is the method used to protect TV channels/ multimedia content while conditional access providers develop their specific key management solution also called Conditional Access Systems (CAS) for managing the access rights to the DVB-CSA protected content.

DVB issued its first security and encryption standard, DVB-CSA in 1994. DVB-CSA technology has been derived in two versions, the CSA1 and the CSA2, both called DVB-CSA, as the only difference relies on the length of the key used. The initial DVB-CSA version was designed in the 90's and is based on the technology that was economically available and possible in consumer products at that time. The algorithm was designed to last for at least ten years. Nearly twenty years later it still remains a robust solution. But, as technology and computing power have increased, the threats to the DVB-CSA have too, and its security margin is ever narrowing.

Even if no attack has yet been published, the rise in increasingly sophisticated means used by professional hackers has called for a far more robust ciphering method for the next decades. This was achieved in 2008 with the publication of the new DVB-CSA3.

The change of a scrambling algorithm is a lengthy process as it has to take into account the long life cycle of set-top boxes that is in the magnitude of several years. The aim is that when CSA2 will effectively reach the end of its life, CSA3 will already be widely implemented and available in all devices for a smooth switchover.

Since its publication, nineteen chipsets designers and manufacturers have been licensed and are are about to start, or are already producing chipsets embedding the new DVB-CSA3 algorithm.

DVB-CSA3 differs from its predecessor by the key length that is now adapted to today's standard, and by the use of a combination of today's best state of the art ciphers. Due to the change of the ciphers, DVB-CSA3 itself is not backward compatible with DVB-CSA. However, chipsets will include both scramblers for backward compatibility.

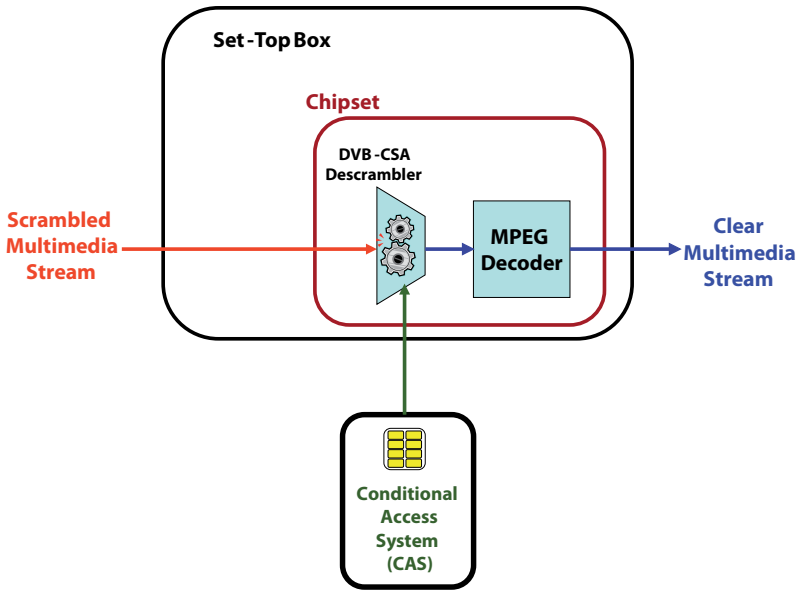
Another main improvement is the multipurpose ability of the new DVB-CSA3 scrambler. It is not only able to protect the legacy DVB MPEG-2 Transport Streams, but also any new type of content and streams, including any purely IP based content formats now used in the IPTV area, for example.

In the same way as DVB-CSA, CSA3 is a secure cipher that includes, and improves, legal enforcement against piracy. DVB-CSA3 as with DVB-CSA is available through licensing to any company asking for it for a legitimate business purpose. The nonprofit licensing is performed by ETSI at administrative cost. The cost of the descrambler license is a single, one time fee of 2200 Euros. Full licensing terms are available on the ETSI website (www.etsi.org).

The use of a license enables the enforcement of the licensing terms allowing legal action against any organization willing to manufacture and sell devices, including CSA3, for piracy purposes (as this would infringe the licensing terms). This is a unique DVB-specific advantage for fighting piracy.

Moving towards a new scrambling technology is a long process when considering legacy devices already deployed in the field. Therefore, choosing CSA3 enabled chipsets in any new device or component is a safe way for enabling a smooth, secure and future proof switch to CSA3 when CSA2 reaches the end of its life.

In conclusion, opting for DVB-CSA3 when implementing DVB-T2/C2/S2, HD or launching a new business based on DVB-T/C/S, is the clever choice.



TV Service Providers Must Use Customer Connection to Compete in Internet Connected World

Myra Moore, Chief Analyst, Digital Tech Consulting

DTC is a boutique market research firm that tracks and analyzes the worldwide consumer digital TV and video marketplace. For more information on the company and its latest market intelligence on the digital TV and video market, please see **www.dtcreports.com**.

To an outside observer one might conclude that traditional TV service providers are facing a bleak future as internet delivered TV providers snatch large swaths of free-to-air and pay TV viewers to get their TV fix from the Web.

Those inside the worldwide broadcasting business recognize the absurdity of this view. Traditional TV services remain the overwhelming sources for TV viewing, and traditional providers are making the capital expenditures to digitize and create new revenue generating services off of system upgrades. According to DTC estimates, digital pay subscribers grew from 316 million in 2009 to an estimated 372 million in 2010, and are expected to surpass 590 million by 2015. Many of these are boosting ARPU where HD, PVR, and other high-end services are being adopted.

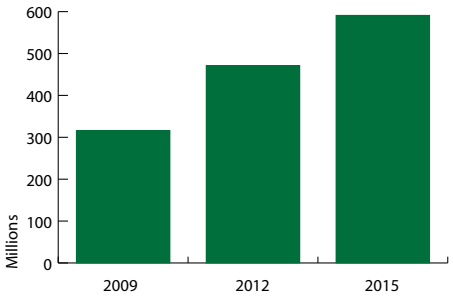
Incumbents, however, also recognize that to ignore the evolution of the internet as a viable TV programming source is folly, particularly as this evolving distribution method becomes more relevant as the gap between the PC and TV is bridged. Video consumption via the internet is on the rise exponentially, with nearly half a billion Internet video viewers estimated at year end 2009, a number expected to exceed 700 million by 2015 according to DTC's latest research.

Only a fraction of these are paying to watch internet TV, but smart programmers and service providers recognize that they must accommodate some internet delivered programming. On-demand libraries that efficiently offer niche programming will likely find their place alongside traditional services but not until traditional providers integrate programming guides that "meld" all programming into a seamless interface and programming guide. The smartest content and service providers are testing new business models that give viewers programs both inside and outside of the pay pen.

Ultimately, the method by which a subscriber gains access to content, whether through the internet, pay TV services, or some combination of the above, is likely to lose distinction over time.

The key to a successful business in the future won't be how a service is connected to a subscriber, but rather the strength of that connection. Pay TV operators start with a natural advantage because they have a strong tie to existing paying subscriber bases. But their future success will hinge on how they can deliver content from multiple sources to a single viewer.

Est. Worldwide Digital Pay TV Subscribers



Source: DTC

AND THE WINNER IS...

DVB-T2 Scoops IBC Innovation Award

Ulrich Reimers (Chairman DVB-TM), Alan Boyle (BBC) and Nick Wells (BBC) receiving the IBC Innovation Award 2010 from David Crawford (IBC)

At this year's IBC, the DVB-T2 transmission system was honoured with the IBC Innovation Award for Content Delivery technology. At the IBC ceremony, the award was presented to the BBC for its successful implementation of the DVB-T2 advanced transmission technology.

BBC's Research & Development along with 60 other DVB member companies collaborated to develop DVB-T2, the second generation terrestrial broadcasting format.

Prof. Dr.-Ing. Ulrich Reimers, chairman of the DVB Technical Module, commenting on the award said, "On behalf of the 240 member companies of the DVB Project I happily welcome the Innovation Award presented today to the BBC Research and Development Department and to DVB".

DVB-T2 is the world's most advanced digital terrestrial transmission system offering a 50 percent increase in efficiency over any other DTT system in the world.

The UK's Freeview HD service was launched officially in March this year. Since then Italy has seen the recent launch of DVB-T2 for pay-TV services. Sweden launched DVB-T2 HD services in early November and Finland start their DVB-T2 HD services in early 2011. Advanced trials are currently taking place in Austria, Denmark, the Czech Republic and Germany. More and more other countries are considering launching services using DVB-T2 in the near future. Outside Europe, Sri Lanka has announced their intention to launch directly with DVB-T2. Other countries that are considering DVB-T2 are Australia, India, Kenya, Malaysia, Singapore and Thailand.

Hi-Def Reality

Commercial Launch of HDTV With DVB-T2 in Sweden

Erik Stare, Senior R&D Engineer, Teracom

In Sweden a commercial launch of HDTV services has just taken place in the terrestrial network using the new DVB-T2 standard. On November 1 two multiplexes began broadcasting HDTV to two thirds of the population. Within one year this coverage is planned to increase to 90 percent and by the end of 2012 to 98 percent.

Broadcast licenses for nine HD channels have been issued with the requirement to start services no later than January 1, 2011. These nine channels include five of the most popular TV channels in HD versions and four other channels. Two channels (SVT) are free-to-air and the other channels are, or will be provided via the pay TV operator, Boxer. Test transmissions have been going on during 2010 and the network is currently being rolled out by the network operator Teracom.

Teracom currently operates five nationwide DVB-T networks carrying mainly MPEG-2 SD services and also some MPEG-4 SD. Up until late spring this year a sixth DVB-T network was also in use carrying MPEG-4 SD with 70 percent coverage. In order to clear this multiplex for DVB-T2 use the services have been moved to multiplex 1-5. A new generation of video encoders has made it possible to perform this move without compromising picture quality on existing services.

Multiplex 6 will use UHF channels within the range 21-60. According to the Geneva plan for frequency planning (GE06), Sweden, as with many other countries, has

HD Services
SVT1 HD (Free-to air)
SVT2 HD (Free-to air)
TV3 HD
TV4 HD
Kanal 5 HD
CANAL+ Sport HD
Viasat Sport HD
National Geographic HD
MTVN HD

frequency allocations for seven nationwide networks on UHF. However, due to the clearing of channels 61-69 the remaining UHF spectrum will only allow for about six and a half nationwide networks. Sweden has also one 7 MHz DVB-T allocation in VHF band III, which can be converted to DVB-T2. However, before analog TV is switched-off in all neighboring countries, there are for reasons of interference some restrictions in the use of VHF band III, which makes it difficult to build a complete network based on VHF band III only. However, when combining the remaining UHF spectrum with the VHF band III spectrum that is already available, a complete nationwide network can be built. So the frequency planning basis for multiplex 6 and 7 is that multiplex 6 will be based on UHF only, whereas multiplex 7 will be based on a mixture of UHF and VHF band III spectrum with about 50 percent each.

The capacity on multiplex 6 is 36.6 Mbit/s and 30.8 Mbit/s on multiplex 7. The main reason why multiplex 7 has a lower capacity is that the VHF band III channel spacing is 7 MHz instead of 8 MHz on UHF. The DVB-T2 parameters that are used are similar to the ones chosen for the UK, but with guard intervals appropriate for large SFNs, which decreases the bitrate somewhat. So in Sweden DVB-T2 will also initially be used based on conventional SISO transmission, single-PLP, 32K FFT, 256-QAM and code rate 2/3, although some other code rates will also be used in combinations with different guard intervals to fit the various SFN sizes. Multiplex 6 will use two different modes, whereas multiplex 7 will use three (two in VHF and one in UHF).

The video format is 720p for HD services, and for content produced in 1080i. The reason for this is the higher compression efficiency using 720p, as well as the better picture quality for content with a lot of motion. Since IDTVs normally display in progressive format, source material in interlaced format requires a non-trivial interlace-to-progressive conversion at some point in the chain and doing this with professional equipment with studio quality video material allows a better quality conversion than using decompressed video in consumer devices.

MPEG-4 HE-AAC audio compression is used for all MPEG-4 services. HD services will typically be accompanied by 5.1 surround sound, which in the receivers will either be passed through to the home audio system or be decoded and down mixed to stereo, depending on consumer settings.

Get Ready For DVB World 2011

The DVB World 2011 conference will celebrate the eleventh anniversary of the biggest annual event dedicated to DVB technology. Next year's conference will take place in the lovely city of Nice in the South of France. DVB World 2011 will take place from Monday 7th to Wednesday 9th March in the Hotel Le Meridien, Nice. DVB World 2011 will continue to focus on DVB standards, services and technology.

DVB dominates the digital broadcasting environment with thousands of broadcast services around the world using DVB's open standards. There are hundreds of manufacturers offering DVB compliant equipment. To date there are over half a billion DVB receivers shipped worldwide. DVB standards are also widely used for other non-broadcasting applications such as data on the move and high-bandwidth internet over the air.

Each year DVB World attracts hundreds of delegates from DVB member companies and non-member companies around the world. The conference offers a unique opportunity to learn about the latest developments from the people at the very heart of the digital revolution. With an emphasis on useful information, informed analysis and projections, this is an unrivalled event dedicated to DVB standards and services.

The first day of DVB World 2011 will begin with a series of flagship presentations that will set the agenda for the following days. These sessions will include topics such as 3DTV, Ultra HDTV, the influence of the IP world and Hybrid Broadcast/ Broadband, chip developments, and asking if smartphones have changed the mobile TV business case? Changes in the media and entertainment technology landscape and changes in media consumption behavior will also be discussed. Experiences with

current DVB systems, DVB deployments around the world, as well as the state of play with second generation DVB standards are also on the agenda.

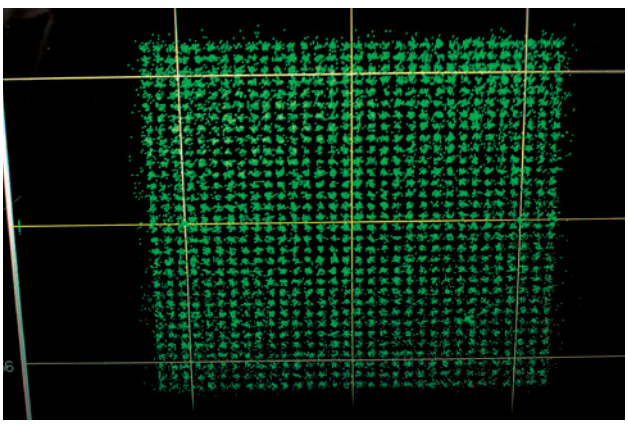
Prof. Ulrich Reimers, Chairman of the DVB Technical Module, will again present the ever popular 'DVB Masterclass' for newcomers to the world of DVB or those looking for a refresher course in DVB standards.

The full conference program and information on how to register and book accommodation will be available on the DVB World website: www.dvbworld.org. See you in sunny Nice.

First DVB-C2 Field Test Completed Successfully

Up to 60% more Capacity in Digital Cable Networks

In September, Kabel Deutschland successfully carried out DVB-C2 transmission tests in its Berlin cable network. The second generation DVB transmission standard was published by ETSI five months earlier as EN 302 769 Ver. 1.1.1: Frame structure channel coding and modulation for a second generation digital transmission system for cable systems. During the Berlin tests, DVB-C2 modulated HDTV signals were transmitted on channel D562 together with other analog and digital services in the fully loaded Berlin cable network. The highlight of the tests was the successful transmission of 1024-QAM and even 4096-QAM constellations, the most complex and spectrum efficient configurations of the new DVB-C2 cable standard, in a fully loaded 862 MHz cable network. The test demonstrated DVB-C2's capability to deliver more digital TV channels and even faster internet access in the same spectrum.



On Location

DVB Hosts DVB-T2 Seminar in Thailand

John Bigeni, DVB

The new second generation standard for digital terrestrial delivery, DVB-T2, has aroused unprecedented worldwide interest since its successful inaugural implementation in the UK earlier this year. Already a growing number of countries have decided to trial and implement DVB-T2 networks. This includes Sweden, Finland, Italy, Germany, Denmark, Ukraine, Spain, Austria and Czech Republic. This interest has not been confined to Europe and a number of Asian countries have shown similar interest. It is to be noted that India and Kenya have both issued tender notices for DVB-T2 networks. Why this huge interest? Well, when you think about the enormous benefits that DVB-T2 can bring - this should be no surprise. Coupled with the constantly lowering price of DVB-T2 receivers it becomes logical to think seriously about the DVB-T2 option. There are many countries particularly outside Europe that had opted some time ago to adopt DVB-T. However, due to economic and other circumstances they had not yet made any significant inroads in implementation. In many such instances, activities had not gone much beyond a trial, which at the time dictated DVB-T as the choice. Now on the onset of implementation, with the appearance of DVB-T2, the environment has dramatically changed and in some circumstances leapfrogging directly into DVB-T2 starts to make both technical and economic sense. News from Sri Lanka indicates that the country will migrate to digital with DVB-T2.

Now, we are constantly being requested to arrange seminars and demonstrations of this new remarkable standard. One such seminar was recently held in Thailand.

Thailand had conducted successful extensive DVB-T trials some time ago, however, until now had been waiting for the establishment of the government broadcasting authority before they could formally decide and announce a digital standard. The formation of this body is now expected in the next few months. The National Telecommunications Commission (NTC) is currently responsible for regulating the broadcasting industry until such time as the broadcasting authority is in place.

A two day seminar, held in Bangkok, was jointly organized by DVB and the NTC. Many of the presenters were representatives of DVB member companies and related organizations. Those representing DVB at the seminar included: Richard Lindsay-Davies, DTG; Bob Hannent, Humax; Albert Canigueral, ADB; Colin Prior, S & T; Clive Morton, Morton Davies Consulting; Emmanuel Jacques, Enensys; Kenelm Deen, Ericsson; Laurent Le Morvan, STMicroelectronics; Nils Ahrens, Rohde & Schwarz; Pascal Gelugne, ATDI; and Peter Siebert and John Bigeni, DVB.

The keynote address by Richard Lindsay-Davies, Director General, DTG, provided an excellent report of the UK's experience with the planning and successful DVB-T2 rollout.

DVB Executive Director, Peter Siebert provided the introduction to DVB and the background to the development of second generation standards. Other presentations covered all aspects of the DVB-T2 standard and its underlying technologies, its advantages and performance in comparison with other standards, transmitter network implementation, receivers, chipset availability and finally, middleware solutions.

NTC provided a number of Thai speakers that contributed significantly to the seminar program. These speakers included Prof. Pana Thongmeearkom, NTC, Dr. Phansak Sirirachpraphong, NECTEC and Mr. Pairoj Pinkaew, Channel 3. The eminent speakers covered the local issues such as the status of activities with digital terrestrial planning in Thailand through to issues including the social impact and commercial potential of digital television.

The seminar's effectiveness was greatly enhanced by a number of very impressive exhibits. They included the transmission of four HD services through a DVB-T2 modulator to large screens. Reception was through a variety of DVB-T2 STBs and an IDTV receiver. A number of other exhibits were also arranged by DVB member companies.

The seminar was well attended by more than 250 delegates from the broadcasting industry, government and universities. There was a high level of audience participation and questions, resulting in positive feedback following the seminar.

Finally, it should be mentioned that the seminar would not have been possible without the support of DVB member companies and local support. In this respect, our sincere thanks go to Visuth Humkratoke of TX International who is a great supporter of DVB.

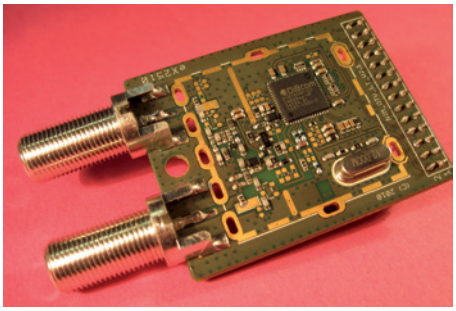
MARKET WATCH

www.oceanbluesoftware.com

Everyday in the UK another 100 people start to lose their eyesight. The prevalence of sight loss increases with age, and the world's population is ageing. Ocean Blue Software has developed text-to-speech software for digital TV devices. The technology, branded Talk@ TV, benefits users who have visual impairments and other disabilities, by voicing the program guide and menu items. The technology incorporates an advanced user interface, specifically designed for varied levels of visual impairment.

www.dibcom.com

DiBcom unveils a cost effective tuner/ demodulator System on Chip (SoC) fully dedicated to DVB-T in complement to the multi-standard Octopus Platform. Pin-to-pin compatible with previous SIP version, this SoC offers digital TV high performance technology for portable or fixed reception. Set-top boxes, TV sets or PCTV can be addressed by these components at a low cost.



www.roverinstruments.com

The Rover Broadcast RTM900 provides three independent 3" color LCD monitors in a 2 unit high 19" rack mount mainframe. Each LCD monitor can display the video content provided by three different sources – SDI (with embedded audio CH1-2 group1), CVBS, ASI and provides an analog audio output jack; the ASI signal is routed internally to the three LCD's. Each LCD can decode and display an MPEG- 2 & 4 H.264 compressed SD/HD video service, selected via a front panel menu.

www.agilent.com

Agilent offers as a DVB-T2 solution a general purpose signal generator and signal analyzer. For transmitter tests, all of the company's X-Series signal analyzers need only a firmware update to support DVB-T2 measurements with MER, L1-Signalling and channel impulse response, etc. For receiver tests, its signal studio for digital video N7623B can generate standard DVB-T2 signals and support AWGN, static multi-paths, multi-carriers or fading tests for receiver performance test, R&D or manufacturing tests.

www.cisco.com

The Cisco D9036 Modular Encoding Platform provides multi-resolution, multi-format encoding for applications requiring high levels of video quality. The D9036 utilizes next generation silicon, providing significant improvement in video quality over past generation encoders. This hot-swappable modular platform is scalable, supporting up to eight SD or four HD broadcast or secondary distribution encoding services within a 1RU chassis, while providing broadcast quality video and consuming as little as 40 watts per service.

www.technisat.com

TechniSat upgrades its product range of IDTVs with "MultyVision ISIO" which extends the established multi-tuner concept with another reception technology – IP. The hybrid function enables the access of interactive offers, free browsers and VOD services. The introduction of their "ISIO Live" platform also includes numerous apps.
The Edge-LED technology enables brilliant and sharp pictures. Various connectors allows for the creation of a multimedia center which can, due to UPNP technology, be integrated easily into home networks.

www.silabs.com

Silicon Laboratories has introduced a single-chip, multi-standard digital multimedia TV demodulator that combines satellite, terrestrial and cable functions in one highly integrated device. The Si2167, offered in a tiny 48-pin 7 mm x 7 mm QFN package, simplifies the design process and significantly reduces the overall electrical component BoM of integrated digital TVs, set-top boxes, personal video recorders, network interface modules, PCTV accessories, and professional video DVB receivers.

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- **CMMB (GY/T 220.1-2006 and 220.2-2006)**
- **DTMB (GB20600-2006 and GY/T 229.1-2008)**

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