ITEA 2

INFORMATION TECHNOLOGY FOR EUROPEAN ADVANCEMENT

HDTVNEXT

INNOVATION REPORT

Cross industry co-operation ensures fully functional end-to-end Full HD broadcast chain

Project leader: Dominique Défossez (NXP Semiconductors France)

The ITEA HDTVNext project has led to the development of all the necessary technologies required for the complete end-to-end broadcasting chain – from professional TV studios and broadcasting equipment to consumer TVs – to handle next-generation 'Full HD' 1080p 50Hz high-definition television signals. Commercial exploitation of many of these elements is already starting, including the use of automatic content creation and the availability of the world's first Full HD professional TV camera.

High definition television (HDTV) is now available in an increasing number of countries, offering higher levels of entertainment value for ever wider audiences. The HDTVNext project set out to reduce the remaining discrepancies between the various elements in the end-to-end HDTV chain to ensure Full HD format maturity in acquisition, distribution and user access.

Initially, HDTV was seen as anything that was not standard definition. This covered several different formats to match available transmission channels – terrestrial, satellite and broadband Internet – but has been confusing for users.

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The earlier ITEA HD4U project developed the 'HD ready' 720p format. HDTVNext focused on the so-called Full HD 1080 progressive (1080p) format which provides a 1080-line by 1920-column image at 50 images a second. This technology is intended for both broadcast and broadband Internet TV applications as well as enabling HD access through home networks and allowing HD video on demand.

Technically achievable target

Extensive market analysis showed that the 1080p 50Hz format was a technically-achievable target for the end-to-end chain and provided the highest definition that the eye of the average viewer can see. However, while consumer TVs were already able to handle the Full HD format, other elements of the chain, particularly the encoders in the TV studios and decoders in the transmission circuits, were not. There was a particular problem in the professional recording studios that were not able to handle 50 pictures a second.

The principle objectives of HDTVNext therefore included defining a coherent end-to-end structure using the 1080p 50Hz format that was flexible enough to handle audiovisual programmes from different sources and scalable to heterogeneous bandwidth capacity. It was also necessary to increase the bandwidth capacity to 3 Gb/s at the content production level and to ensure interoperability and backward compatibility with existing terminals able to handle HD contents while allowing real-time 1080p 50Hz high definition processing

All members of the HDTVNext consortium were players and experts in the various elements of the HDTV chain. However, they had been working separately before – so it was difficult to optimise their equipment for the Full HD format. For example the partners working on the decoders at the end of the broadcast chain had no links with those working on the encoders at the beginning the chain – so the algorithms used were not optimised.

At the same time, the ITEA project enabled collaboration on products for particular markets. For example, in Spain, four partners worked together on specific products for teaching students through video systems built on different technologies through the consortium. And three partners in France worked on a crosscoder between JPEG2000 and H264 – two formats used most widely in TV recording studios.

Key advances achieved

Key advances included:

- Encoding and decoding algorithms for the integrated circuits used for both the front and the end of the chain supporting the H.264/MPEG-4 – or advanced video coding (AVC) – standard. This video-compression standard is capable of providing good video quality at substantially lower bit rates than previous standards;
- Automatically-generated contents and user-generated contents superimposable over the normal video flow;
- A professional TV camera able to acquire Full HD format signals at 50 images a second; and
- Interactive application.

All of these elements are now available in Full HD instead of HD-ready format, enabling professional studios, broadcasters and domestic users to interact using the same HD format. In addition, HDTVNext developed audio digital signal processing (DSP) rendering algorithms and scalable video coding (SVC) intellectual property for backward compatibility with lower resolution formats.

Specific technical advances included audio DSP rendering to enable the adaptation of sound environments for different rooms.

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This enables a system to learn the topology of a room and adapt the sound output accordingly.

A second innovation was an SVC decoder that makes use of a totally new concept in co-operative algorithms for video compressions. This permits automatic adjustment of the decoder to available bandwidth – for example, if there are WiFi restrictions or bad lines, the decoder will use only part of the format, ensuring there is no interruption in the signal flow despite degradation in the connection.

Rapid exploitation expected

The main business impacts of HDTVNext are extensive with a major effort put into encouraging rapid exploitation of the results. Some 15 different products are now emerging – from automatic content creation for regional broadcasters, to video transcoders, power-line communications (PLC) extenders, wireless transmissions, security, HD video on demand, broadband TV transcoders, SVC decoders, H264 encoders, set-top boxes, TV interactivity, JPEG2000 decoders, cameras, user-generated contents, widgets, acoustic adaptation, interactive platform and HD conversion.
Specific applications include:

- Automatic content creation that is already being used for weather forecasts on Catalonian channels in Spain;
- The first Full HD professional cameras worldwide that are now on the market following demonstration for football matches in Barcelona; and
- The first SVC-capable decoder – essential for US broadcasters – which will be available at the beginning of 2011.

Even more importantly, encouraging wide adoption of the 1080p 50Hz Full HD format is less confusing for users – and opens the way to a coherent approach for the introduction of 3D TV. HDTVNext built on the results of the ITEA HD4U project dedicated to the end-to-end HD Ready format and in turn is a predecessor to the ITEA JEDI project dedicated to the 3D format end-to-end chain.

Securing investment choice

This project focused on systems-oriented interactive algorithms and was initiated by Thomson. NXP took the leadership as the decoding element was considered as key. There were 21 partners involved to complete the chain; all demonstrations, four platforms and potential exploitation each involved several partners. ITEA provided a well-defined structure that enabled all the partners to work together.

A major overall benefit was the capacity to define a common view between academics and industry on the future for multimedia distribution. European partners are now one step further in their view of the video roadmap. For instance, in the 3D market, at the moment, each TV maker is proposing its own proprietary format, making the user confused. Instead, HDTVNext used an end-to-end roadmap from HD Ready to Full HD to 3D and took advantage of the expertise of all members all along the chain.

The technology selected is securing the investment choices made by the industries involved, while comforting the users in their TV investments. This gives credibility and technical advance in European innovation.