



PENTA CAVIAR project brings added UHD-4K TV viewing excitement for sports fans

Super slow-motion UHD-4K over 100G ST 2110

Paris 27 May 2021- Over the past five years, 4K Ultra HD TV (UHD-4K) has been rolled out worldwide bringing viewers four times higher resolution, higher dynamic range (higher contrast and picture quality) and a wider colour gamut. But until now, UHD-4K TV could not show the slow-motion replays that are such a big part of watching sport on TV. So, EVS and Grass Valley teamed up in this CAVIAR project. They combined Grass Valley's new camera with EVS's digital production and server technology to make slow motion in 4K a reality. The result – UHD-4K TV has got even better for sports fans.

Slow-motion replays are an integral part of TV sports coverage. Many sports rely on replays to show viewers critical action in more detail and to help match officials to judge these actions. And it's not just technical, slow motion brings emotion. However, creating smooth slow motion requires a camera and a recording system that can shoot faster than the normal rate of 50 or 60 frames per second. Capturing more pictures than normal, then playing them out at the normal rate means the viewer sees them as slow motion: smooth motion at a slower speed.

In this project, the partners aimed to enable 4K Ultra HD TV slow motion at the 'sweet spot' for replays, where images are captured at three times slower than the normal frame rate. The technical challenge was to connect the output from Grass Valley's camera which supports this frame rate to EVS' digital video production systems and servers. This combination would allow broadcasters with EVS systems to receive images from the camera via a cable or fibre IP network and then broadcast them on to viewers.

The project built on two elements. Firstly, the EVS XT-VIA video servers, which have been able to support Slow Motion with a 3 times slower frame rate configurations in UHD-4K format since early 2019. Secondly, the Grass Valley LDX100 camera, which became available at the end of 2020, and was the industry's first camera to support broadcast quality three times UHD-4K. The camera can transmit images over coax cable (12G-SDI) and via IP protocols on 100GE fibre (ST 2110). By transmitting digital data over IP networks using industry IP-standard SMPTE 2110 streams, the camera allows for 'flexible topologies': that is, it can be part of readily expandable cable and fibre broadcasting networks.

Although the video server existed already, integrating the Grass Valley camera with the EVS XT-VIA server called for new technical solutions. The issue lay in volumes of data being transmitted: under the ST 2110 protocol, each UHD-4K phase is transported in full resolution, which exceeded the bandwidth of the 10G Ethernet interface of the XT-VIA IP rear panel (in 59.94Hz).

To solve this challenge, the project partners turned to the EVS-built XHub-VIA switch. This switch was already being used as a Live IP Aggregator (a technology that dynamically routes live TV digital data over networks in the most efficient way). This helped overcome the bandwidth limitations, but only up to a maximum three streams of full resolution HDTV (9G in total) – still not enough for UHD-4K when transported over a single fibre cable. The ultimate solution was for the XHub-VIA IP Aggregator to remap the incoming triple speed 4K streams of 36 giga bits per second (Gb/s) to three non-conventional 12.5 Gb/s interfaces of the XT-VIA server. With this solution in place, the XHub-VIA can connect to the Live IP fabric (its collection of switches) at the necessary 100G speed.



The diagram shows the complete LDX 100 – XHub-VIA IP Aggregator – XT-VIA workflow. At the top left is the LDX 100 which generates the triple speed and live feed streams (3 phases and 1 combined signal to create the normal single-speed UHD-4K signal) and receives back the normal speed UHD-4K playout of the XT server. A 100G Mellanox switch (top centre) dispatches those streams between the LDX 100 camera and the XHub-VIA IP Aggregator, as well as the PTP (Precision Time Protocol) messages generated by the Meinberg PTP to synchronize all parts in the system. The video/audio content arrives at the EVS XT server through the XHub-VIA IP Aggregator. The video/audio content arrives at the EVS XT server through the XHub-VIA IP Aggregator.

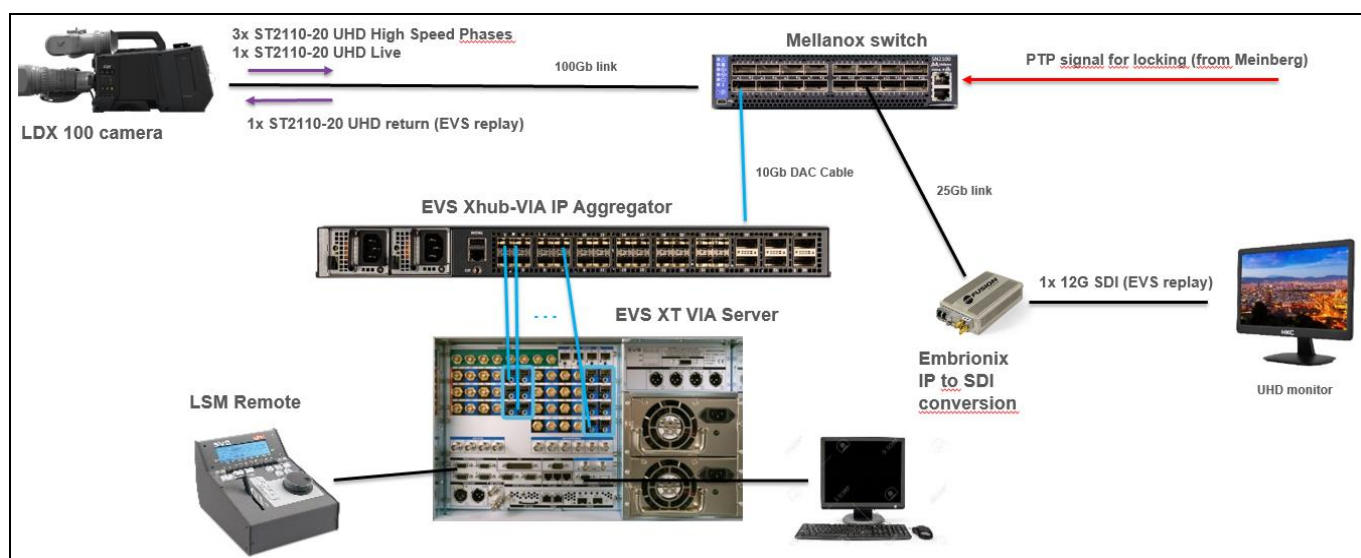
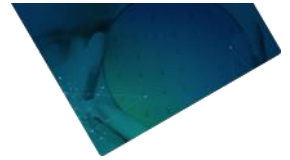


Figure 1 – LDX 100 / XHub-VIA / XT-VIA workflow

Even though the XHub-VIA is another physical device, when used as an IP Aggregator, it becomes part of the EVS XT/XS system. A Multicam application, which is running on the XT server, manages both the XHub-VIA and the XT-VIA server through a dedicated management connection.

The new LDX 100 generates IP directly in the camera body. Open (SMPTE) protocols transmit and receive audio, video and intercom streams, and industry standard AMWA-NMOS (Networked Media Open Specifications) protocols are used for the device connection management, while PTP synchronizes the camera with the rest of the network.

EVS and Grass Valley have worked closely to integrate the new system elements on all levels: compatibility of the ST 2110-20 streams, synchronization through PTP and control through NMOS IS-04 and IS-05, and in particular, compatibility between Session Description Protocols generated by the LDX 100 and the XT-VIA server. This collaboration has led to a major advance in UHD-4K TV, providing opportunities for content providers/broadcasters to deliver slow motion and for viewers, especially sports fans, to be able to relive memorable moments in all their exciting detail.



About the PENTA programme

PENTA is a **EUREKA** cluster whose purpose is to catalyse research, development and innovation in areas of micro and nanoelectronics enabled systems and applications. Guided by the [Electronic Components & Systems \(ECS\) Strategic Research and Innovation Agenda \(SRIA\)](#) four technology layers, four cross-sectional technologies and six ECS key application areas, the PENTA programme enables the development of electronic solutions to help drive the digital economy through the formation of collaborative ecosystems along the ECS value chain. This creates the opportunity for rapid competitive exploitation and a strong impact on European societal challenges. PENTA supports SMEs, large corporations, research organisations and universities to work together in project consortia by facilitating access to funding, fostering collaborative work and creating consortia in areas of mutual industrial and National interest. PENTA is managed by the Industry Association AENEAS

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About the CAVIAR project

CAVIAR is a RD&I project consortium involving 9 partners from 4 countries. The project partners are: Grass Valley Nederland BV (Project leader), 3DHISTECH Ltd, AMS Sensors Belgium, Adimec Advanced Image Systems BV, EVS Broadcast Equipment Brussels (Belgium), EVS Broadcast Equipment SA, MS EYE TECH, TNO and Université de Bourgogne. Belgium, France, the Netherlands and Hungary Public Authorities are funding the project.

More about CAVIAR: <https://caviar-project.org/>