datasheet

Virtuoso Media Function

Nevion Virtuoso

JPEG XS UHD/HD in TS over IP

Nevion Virtuoso's JPEG XS media functions offers multi-channel JPEG XS encoding or decoding for UHD and HD for wide-area broadcast contribution and other high quality media transport applications.

JPEG XS (ISO/IEC 21122) is a modern light-weight encoding standard for video that achieves pristine visually lossless output (both for one-time and multiple concatenated compression), at sub-millisecond latency, i.e. a fraction of a video frame.

The bandwidth required with JPEG XS is typically only 10-20% compared to uncompressed, which gives substantial network bandwidth savings. This makes JPEG XS extremely attractive for low latency real-time transport of HD and 4K/UHD video over campus, metro and wide-area networks.

The JPEG XS in TS encoder/decoder runs on the Virtuoso HBR accelerator cards, supporting electrical and optical SDI interfaces via video SFPs.

A single HBR card supports JPEG XS encoding or decoding of up to 4 HD or 2 UHD signals. The compressed JPEG XS in Transport Stream over IP signals are aggregated on an uplink module in Virtuoso for wide-area transport

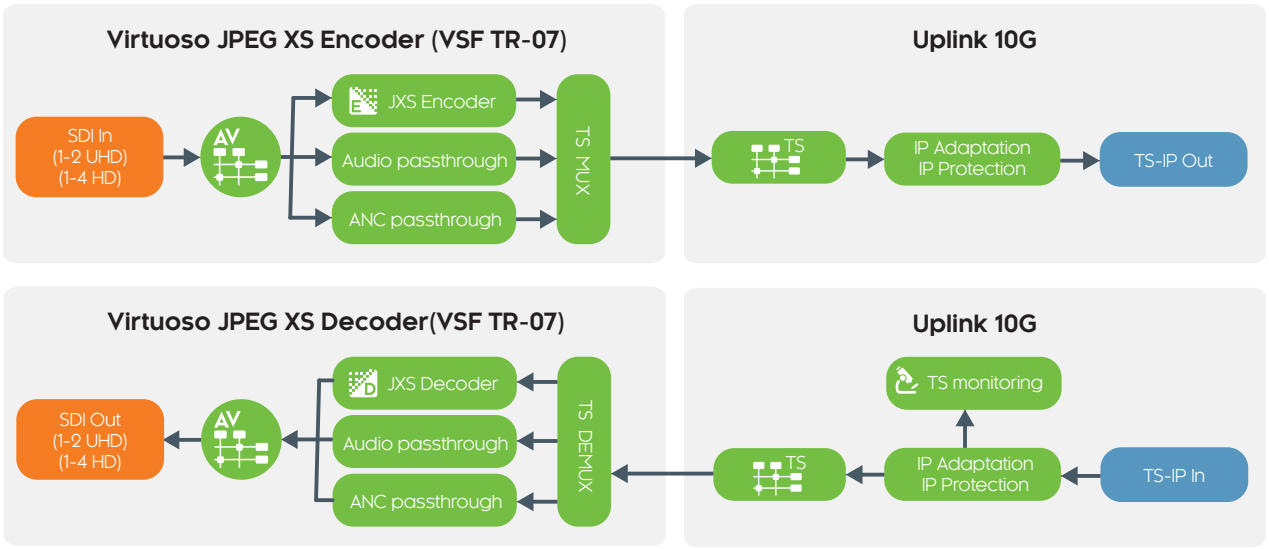
Applications

- Broadcast contribution networks
- Service provider managed networks

Key features

- JPEG XS compression for video
  - Multi-channel UHD/HD encoding/decoding
  - Visually lossless compression
  - Ultra low sub-frame end-to-end latency
- Standards-based interfacing
  - JPEG XS in TS over IP (VSF TR-07)
  - HD/3G/12G-SDI (electrical or optical)
- Video/Audio processing
  - Transparent audio (16 channels, 24-bit)
  - Transparent ancillary data (up to 1 Mbits/s)
  - Audio shuffling, gain and delay option
  - Built-in frame synchronizer option
- Stream protection
  - SMPTE 2022-1/2 TS over IP with FEC
  - SMPTE 2022-7 Seamless/hitless protection
  - Clean video switching (MBB, BBM)
- Monitoring and control
  - HTML5 user interface for configuration
  - Thumbnails of input and output video
  - Built-in TS and RTP/IP monitoring
  - NMOS IS-04/05/08 and REST API control

Nevion Virtuoso JPEG XS in TS Media Function



Functional diagram (HBR 10G)

High video quality and low latency

JPEG XS (ISO/IEC 21122) is a modern and light-weight encoding standard that achieves pristine visually lossless video quality with millisecond latency, i.e. a fraction of a video frame. In addition, JPEG XS is also highly robust to multiple concatenated compression cycles, which is common in live broadcast production and transport applications.

High quality compression is achievable with ratios up to 10:1 and beyond, depending on the application.

When to use JPEG XS in TS over IP

Nevion Virtuoso offers multi-channel JPEG XS UHD/HD encoding or decoding capabilities on a single Virtuoso accelerator module (with each Virtuoso supporting multiple accelerator modules).

For WAN transport, there are two choices, essence-based SMPTE 2110-22/30/40 (VSF TR-08) or multiplexed Transport Stream over IP (VSF TR-07).

The sweet spot of JPEG XS in TS (VSF TR-07) is for media transport of multiplexed video and audio with built-in program timing and metadata information, simplifying hand-off between broadcasters and service providers, or different broadcaster locations. But no matter your preference, you will find that Virtuoso can adapt to all requirements.

Input to the JPEG XS encoder can be uncompressed video in either SDI format, on the HBR10 accelerator, or IP (SMPTE ST 2110-20) on the HBR25 accelerator. The output of the encoder is SMPTE ST 2022-2 compliant Transport Stream over IP.

High density and flexibility

Different input formats, SDI or IP, allow the different workflows to be accomodated.

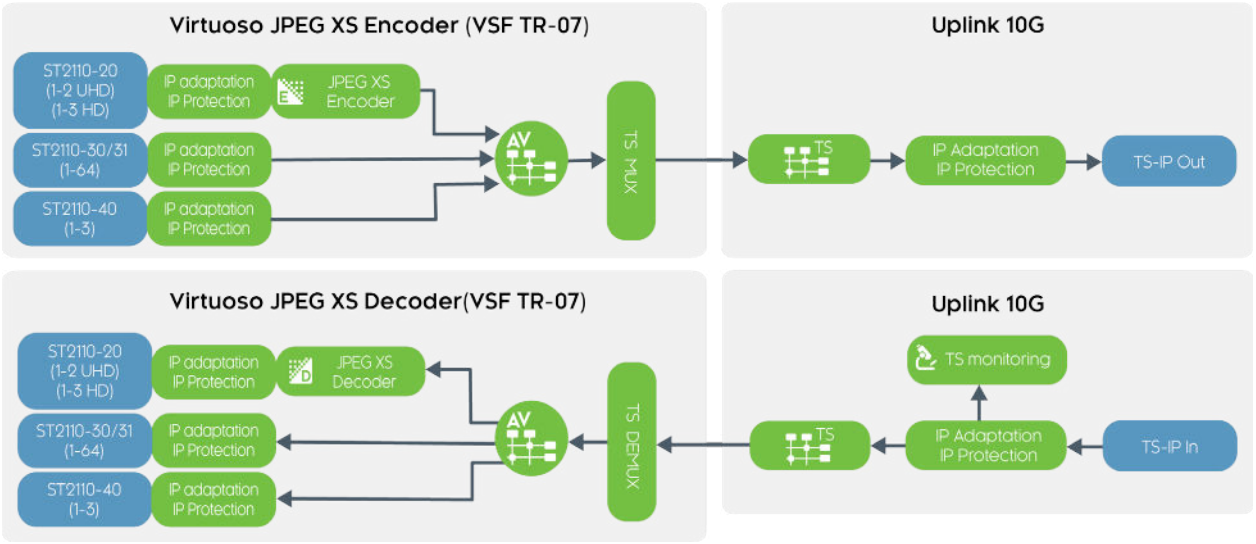
The JPEG XS in TS media function supports encoding or decoding of up to 4 HD or 2 UHD channels. The Uplink 10G media function is used for TS over IP adaptation, IP protection and monitoring.

The max density of JPEG XS Transport Streams per Uplink in Virtuoso MI/RE, is determined by the data throughput limitation of the Uplink module (see datasheet).

Providing the aggregated total bandwidth is within limits, running on the Virtuoso HBR 10G accelerator, the JPEG XS media function supports encoding or decoding of up to 4 HD or 2 UHD channels, giving a maximum density of 28 HD or 16 UHD channels in Virtuoso MI. 20 HD or 10UHD channels in Virtuoso RE.

Running on the Virtuoso HBR 25G accelerator, the JPEG XS media function supports encoding or decoding of up to 3 HD or 2 UHD channels, giving a maximum density of 21 HD or 14 UHD channels in Virtuoso MI. 15 HD or 10 UHD channels in Virtuoso RE.

A mix of encoding and decoding in the same Virtuoso is possible and is configured per HBR accelerator card. Similarly, HD and UHD can be combined and is configured per HBR card.



Functional diagram (HBR 25G)

Standards compliant transport

The software uses VSF TR-07 JPEG XS transport, in TS over IP ensuring compatibility with 3rd parties.

Flexible SDI interfacing via SFPs

The JPEG XS media function on the HBR10 accelerator supports HD/3G/12G-SDI via optical/ electrical video SFPs or HD/3G-SDI signals via Nevion breakout cables

Transparent audio & ancilliary data

The JPEG XS media function supports transmission of up to 16 channels of embedded audio. Handling of embedded audio, whether it's linear PCM or pre-compressed audio, is fully transparent. Similarly, handling of ancillary data such as closed captioning, active format description, time code and other metadata is fully transparent line-by-line.

Audio processing

Audio processing includes de-embedding of SDI and IP audio inputs, flexible internal routing and output embedding, as well as gain/delay control and automatic re-alignment of Dolby E audio.

Audio delay can be adjusted on a channel-by-channel basis, up to 10 seconds. Audio level/gain can also be adjusted on a per-channel basis.

Reliability and IP protection

Standards-based Forward Error Correction is supported with SMPTE ST 2022-1 to detect and correct intermittent packet loss. The software also supports alarm-based input switching between different video inputs.

Seamless IP protection switching

Transmitting the same RTP/IP stream across dual, fully diverse network links enables receivers/decoders to utilize SMPTE ST 2022-7 Seamless IP Protection Switching, which gives error-free transport even in case of severe packet loss or link outages as long as a packet arrives on either of the two network links. Support for ST 2022-7 requires the protection license.

Built-in TS monitoring probe

Monitoring of signals at demarcation points between e.g., a broadcaster and a service provider, is key to quickly identify and resolve issues.

In Virtuoso, all ASI and IP Transport Stream inputs are monitored according to ETSI TR 101 290 Pri 1 alarm conditions. The advanced monitoring option adds Pri 2 alarms, PCR validation and jitter measurements, as well as PSI/SI table analysis.

Test image transmission

The JPEG XS media function can transmit an internally generated color bar or custom test image with configurable text overlays and moving patterns, to allow efficient testing of links prior to a live production.

Virtuoso JPEG XS in TS Media Function (HBR10)

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Video formats

HD-SDI	SMPTE ST 292/ST 296/ST 274 1280 x 720p: 50/59.94/60 Hz 1920 x 1080i: 25/29.97/30 Hz 1920 x 1080p: 23.98/24/25/29.97/30 Hz 2048 x 1080p: 23.98/24/25
3G-SDI	SMPTE ST 424 (Level A)/ST 425-1 1920 x 1080p 50/59.94/60 Hz 2048 x 1080p: 47.95/48/50/59.94/60 Hz
12G-SDI	SMPTE ST 2082-10 (mode 1)/ ST 2036-1 3840 x 2160p: 50/59.94/60 Hz

SDI interfaces

SDI interfaces	12G/3G/HD-SDI Video SFP with options for: - Dual channel SDI RX (input) - Dual channel SDI TX (output) - Single channel SDI RX + SDI TX (bidirectional) - Optical and electrical variants 3G/HD-SDI video breakout with options for: - Dual channel SDI RX + SDI TX - Dual channel SDI RX with passive loop out

Video processing

Input/output video	YCbCr, 4:2:2,10 bit per component
Colour formats	ITU-R BT.709 (HDTV) ITU-R BT.2020-2 (UHDTV) ITU-R BT.2100 HDR (HLG / PQ)
Legaliziation	Yes
Frame sync	Yes
Sync reference	Analog BB/TLS via Virtuoso appliance PTP via 10G on HBR card
Video delay	Yes, up to 10 frames additional delay
Test patterns	75% and 100% Bars, SMPTE RP 219, SMPTE EG 1 EIA RS-189-A, EBU TECH-3373 HDR/HLG Flat-field with configurable colour Custom test image (BMP/JPG/PNG) Configurable text overlay Moving box/bar

Video compression

Video compression	JPEG XS (ISO/IEC 21122) High Profile
Compression mode	Encoding or Decoding
Channel density	Up to 4 channels of HD Up to 2 channels of UHD
Bit rate	Maximum 4 bit per pixel (bpp) HD 1.5G: up to 295 Mbit/s HD 3G: up to 565 Mbit/s UHD 12G: up to 1550 Mbit/s

Audio and ancillary data

Embedded audio	16 channels (8 stereo pairs) Linear PCM 24-bit audio (48kHz) AES3 non-PCM audio pass-through ST302 transport in TS (2x AES3 per PID)
Ancillary data	Pass-through of ancillary data packets ST2038 transport in TS.

Audio / Video processing

De-embedding audio channels from SDI audio inputs
De-embedding audio channels from SDI audio inputs
Embedding audio channels to SDI outputs
Audio routing/shuffling/processing on SDI embedder
Audio delay adjustment - up to 10 seconds per channel
Audio level/gain control - per mono channel
Automatic Dolby E realignment on SDI output
Video frame synchronization
Video delay adjustment - up to 10 frames per channel

Protection

Input switching	8x video switches. Up to 4 inputs per switch Manual or automatic switching based on alarm status and severity

TS over IP input/output

TS over IP	SMPTE ST 2022-2 RTP/UDP/IP (CBR)
Number of streams	Up to 28 JXS/TS IP inputs/outputs per uplink dependant of Uplink throughput
Throughput	Refer to release notes for details

TS over IP protection

Link redundancy	Hitless/seamless switching for all RTP flows compliant to SMPTE ST 2022-7:2019 Class C (High skew) Up to 450 ms path delay difference
Loss protection	SMPTE ST 2022-1 Forward Error Correction 1D Column only, 2D Column and Row Block and Non-block aligned matrix

Property	Values
L (Min, Max)	1, 254
D (Min, Max)	4, 32
LxD (Max)	1024
L+D (Max)	254

Input signal monitoring

Unc video	Thumbnails of video inputs and outputs Freeze and black frame detection (licensed Audio template monitoring: presence, peak and silence (licensed)
RTP/IP monitoring	Bit rate per flow Packet/datagram rate per flow RTP stream continuity Packet delay variation (PDV/jitter) Packet inter-arrival time (IAT)
Basic TS monitoring	ETSI TR 101 290 Pri 1 alarms Listing of services and components Listing of PIDs with bit rates and counters Listing of PSI/SI tables TS and per PID bitrate alarms
Adv. TS monitoring	ETSI TR 101 290 Pri 1 and 2 alarms PCR validation and jitter measurements PSI/SI table decoding and analysis

Media Server Appliance support

Please refer to Nevion Virtuoso Platform datasheet for details.	
Virtuoso MI	Supported in version 1.8 or higher
Virtuoso RE	Supported in version 1.0.8 or higher

Accelerator requirement

Accelerator	HBR 10G Media Accelerator
Description	Multi-channel high bitrate Media Accelerator
Product codes	VIRTUOSO-HW-HBR-SFP4 (24204)
SFP configuration	Port 1: SDI / Video SFP Port 2: SDI / Video SFP Port 3: Not used Port 4: Not used
Video SFP support	Non-MSA 1.5 Gb/s to 12 Gb/s HD-SDI, 3G-SDI: max 2 in + 2 out 12G-SDI: max 1 in + 1 out per SFP port Optical and electrical variants
Power consumption	Maximum 45W

Virtuoso JPEG XS in TS Media Function (HBR25)

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Video formats

IP media interface	SMPTE ST 2110-20/21 (NL sender, W receiver)
Video formats	1280 x 720p: 50/59.94/60 Hz 1920 x 1080i: 25/29.97/30 Hz 1920 x 1080p: 23.98/24/25/29.97/30 Hz 1920 x 1080p 50/59.94/60 Hz 2048 x 1080p: 23.98/24/25/47.95/48 Hz 2048 x 1080p: 50/59.94/60 Hz 3840 x 2160p: 50/59.94/60 Hz

Video processing

Input/output video	YCbCr, 4:2:2,10 bit per component
Colour formats	ITU-R BT.709 (HDTV) ITU-R BT.2020-2 (UHDTV) ITU-R BT.2100 HDR (HLG / PQ)
Legaliziation	Yes
Frame sync	Yes
Sync reference	Analog BB/TLS via Virtuoso appliance PTP via 10G on HBR card
Video delay	Yes, up to 10 frames additional delay
Test patterns	75% and 100% Bars, SMPTE RP 219, SMPTE EG 1 EIA RS-189-A, EBU TECH-3373 HDR/HLG Flat-field with configurable colour Custom test image (BMP/JPG/PNG) Configurable text overlay Moving box/bar

Video compression

Video compression	JPEG XS (ISO/IEC 21122) High Profile
Compression mode	Encoding or Decoding
Channel density	Up to 3 channels of HD Up to 2 channels of UHD
Bit rate	Maximum 4 bit per pixel (bpp) HD 1.5G: up to 295 Mbit/s HD 3G: up to 565 Mbit/s UHD 12G: up to 1550 Mbit/s

Audio and ancillary data

Embedded audio	16 channels (8 stereo pairs) Linear PCM 24-bit audio (48kHz) AES3 non-PCM audio pass-through ST302 transport in TS (2x AES3 per PID)
Ancillary data	SMPTE ST 2110-40 Ancillary Data over IP ST2038 transport in TS.

Video and audio over IP transport

Unc. video	SMPTE ST 2110-20 video in RTP/UDP/IP SMPTE ST 2110-21 Narrow Sender (type N) and Wide Receiver (type W)
Audio over IP	SMPTE ST 2110-30 PCM audio (Level A+B) SMPTE ST 2110-31 AES3 over IP (Level A+B) AES67 compliant (1 to 8 ch per stream) Up to 64 IP audio input and output flows NMOS IS-08 Channel mapping
Ancillary over IP	SMPTE ST 2110-40 Ancillary Data over IP Up to 3 IP input or output flows
NMOS support	SDP (Session Description Protocol) NMOS IS-04 Discovery and Registration NMOS IS-05 Connection Management

Protection

Clean switching	Break-before-make switching (1-2 frames additional latency) Make-before-break switching
Input switching	3x video input switches. Up to 4 inputs per switch 64x Audio input switches supporting IP audio inputs (AES67, ST2110-30/31) Manual or automatic switching based on alarm status and severity

TS over IP input/output

TS over IP	SMPTE ST 2022-2 RTP/UDP/IP (CBR)
Number of streams	Up to 21 JXS/TS IP inputs/outputs per uplink dependant of Uplink throughput
Throughput	Refer to release notes for details

TS over IP protection

Link redundancy	Hitless/seamless switching for all RTP flows compliant to SMPTE ST 2022-7:2019 Class C (High skew) Up to 450 ms path delay difference
Loss protection	SMPTE ST 2022-1 Forward Error Correction 1D Column only, 2D Column and Row Block and Non-block aligned matrix

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RTP/IP monitoring	Bit rate per flow Packet/datagram rate per flow RTP stream continuity Packet delay variation (PDV/jitter) Packet inter-arrival time (IAT)
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Adv. TS monitoring	ETSI TR 101 290 Pri 1 and 2 alarms PCR validation and jitter measurements PSI/SI table decoding and analysis

Media Server Appliance support

Please refer to Nevion Virtuoso Platform datasheet for details.

Virtuoso MI	Supported in version 1.8 or higher
Virtuoso RE	Supported in version 1.0.8 or higher

Accelerator requirement

Accelerator	HBR 25G Media Accelerator
Description	Multi-channel high bitrate Media Accelerator (HW module). 2x25G SFP slots. Additional licenses required for use with media adaptation/compression/ processing/ monitoring functions.
Product codes	VIRTUOSO-HW-HBR25-SFP3 (24645)
SFP configuration	Port 1: Not used Port 2: 25GE (25GBase-LR/SR) Port 3: 25GE (25GBase-LR/SR)
Power consumption	Maximum 45W

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