The Virtuoso JPEG 2000 Media Function provides visually lossless compressed transport of SD and HD signals with ultra-low latency, using only 10% of the bandwidth required for uncompressed video.

Nevion Virtuoso can run multiple instances of the JPEG 2000 Media Function on a single platform with built-in network aggregation to 10G Ethernet.

The JPEG 2000 Media Function requires the HBR Accelerator, which supports SD/HD/3G-SDI input, for encoding or decoding of up to four JPEG 2000 channels per Accelerator.

The VSF TR-01 compliant TS over IP encapsulation ensures perfectly synchronized transport of video, audio and ancillary data, as well as interoperability with 3rd party equipment.

The Nevion Virtuoso JPEG 2000 Media Function, combined with Nevion’s advanced protection mechanisms, enables broadcasters to utilize cost-efficient IP links for the real-time transport of professional media with low bandwidth utilization, combined with extremely high quality and availability.

**Applications**
- Professional broadcast contribution
- Live sports and event contribution
- Studio-to-studio media exchange
- Managed video services over IP

**Key features**
- Multi-channel JPEG 2000 encoding or decoding
- Visually lossless VQ and low multi-generation loss
- Transport of SD, HD and 3G-SDI over IP/ GigE
- Interoperability with 3rd party through VSF TR-01
- Very low end-to-end latency, 3-4 frames with TR01
- Option for ultra-low latency (sub-frame)
- Supports FEC, SIPS / SMPTE 2022-7 and Launch Delay Offset (LDO) IP protection mechanisms
- Integrated frame synchronization on decoder
- User-friendly web GUI for monitoring and control
- Thumbnails for input/output confidence monitoring
- Built-in TS monitoring (ETSI TR 101 290 Priority 1) of encoder output and decoder input, with option for Pri 2 and Pri 3 monitoring including PCR validation
- Software license approach ensures easy and future-proof upgrade path
JPEG 2000 compression technology
Each frame/field is encoded with 4:2:2 10-bit JPEG 2000 Part 1 image compression, typically providing visually lossless video quality (VQ) at a compression ratio of 10:1, so using only 10% of the bandwidth required for uncompressed video. Further, JPEG 2000 has excellent properties in terms of being robust against multi-generation encoding/decoding, which provides improved quality headroom in production.

Multi-channel encoding or decoding
The JPEG 2000 HD Media Function uses the Virtuoso High Bitrate Accelerator. The Media Function has 2 operational modes; encoder or decoder. In both modes, it can support up to 4 channels per Accelerator. Each channel can be an SD, HD or 3G SDI signal (up to 1080p 59.94 Hz).

Standards compliant transport
The software uses VSF TR-01 JPEG 2000 transport, in TS over IP ensuring compatibility with 3rd party.

Transparent audio & ancillary data
The JPEG 2000 Media Function supports transmission of up to 16 channels of embedded audio for SD, HD and 3G-SDI. 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.

Robust operation with frame sync
The decoder includes a number of features to ensure robust operation and graceful degradation in the presence of IP transport impairments; buffering for IP jitter compensation, packet reordering, error correction and highly efficient error concealment, and a built-in frame synchronizer with analog and digital sync inputs. The encoder supports SDI input switching with built-in frame store for clean changeover on loss of input.

Protection and reliability
JPEG 2000 encoding and decoding can be combined with Forward Error Correction (FEC), Seamless IP Protection Switching (SIPS) compliant to SMPTE 2022-7, as well as Launch Delay Offset (LDO).

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

Launch Delay Offset (LDO)
With the LDO license option, an RTP stream copy can be transmitted after a configurable delay on the sender, thereby enabling SIPS-based seamless switching and error free transport on single-ended network links that may suffer from short outages (e.g. 50 ms outages).

Test image transmission
An encoder can be configured to transmit an internally generated test image at a configurable, constant bitrate, with configurable text overlays and moving patterns, to allow efficient testing of contribution links prior to a live event.
Video formats

<table>
<thead>
<tr>
<th>Format</th>
<th>Standards</th>
<th>Resolution</th>
<th>Sampling Rate</th>
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<tbody>
<tr>
<td>SD-SDI</td>
<td>SMPTE ST 259-C, 625/50, 525/60-97</td>
<td>720 x 576</td>
<td>50 / 60 Hz</td>
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<tr>
<td>HD-SDI</td>
<td>SMPTE ST 292, SMPTE ST 296, SMPTE ST 274</td>
<td>1280 x 720</td>
<td>25 / 30 Hz</td>
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<tr>
<td>3G-SDI</td>
<td>SMPTE ST 424 (Level A), SMPTE ST 274</td>
<td>1920 x 1080p / 50</td>
<td>24 / 29.97 Hz</td>
</tr>
</tbody>
</table>

Video compression

- **Video compression**: JPEG 2000 Broadcast Profile (ISO/IEC 15444-1 and VSF TR-01 profiles for SD/HD/3G)
- **Video sampling**: YCbCr, 4:2.10 bit per component
- **Colour space**: ITU-R Rec BT.709
- **Number of channels**: Up to 4 channels of encoding (or decoding) per Accelerator, each configurable for SD, HD, or 3G formats.
- **Encoding bitrate**: Up to 200 Mbit/s for HD, 400 Mbit/s for 3G
- **Video encapsulation**: TR01 over RTP/UDP/IP

Audio and ancillary data

- **Embedded audio**: 8 AES3 stereo channel pairs / 4 AES groups (user selectable), 20 or 24-bit, transparent for linear PCM and non-PCM audio
- **VBI (SD)**: Line 21 closed captioning
- **Ancillary data**: Fully transparent for ancillary data, including but not limited to Time code (SMPTE 12M), Closed captioning (SMPTE 334-1), Active format description (AFD, SMPTE 2016-5) and OP-47.
- **Audio/video sync**: +/- 2 ms

MPEG-2 Transport Stream

- **Transport Stream**: ETSI EN 50033-9, Annex B, 188 bytes/pkt
- **TS over IP**: SMPTE 2022-2 RTP/UDP/IP (CBR)
- **Input TS bitrate**: Encoder: 20 Mbps to 400 Mbps (SPTS/MPTS)
- **Output TS bitrate**: Encoder: 20 Mbps to 400 Mbps (SPTS)
- **Program information**: Encoder output PAT, PMT, SDTa, NIT
- **JPEG 2000 video**: Up to 200 Mbps for HD, Up to 400 Mbps for 3G
- **AES3 audio**: SMPTE 302 pass-through (48 kHz, 20 or 24-bit)
- **Ancillary data**: SMPTE 303B pass-through up to 1 Mbps

IP transport and protection

- **Protocols**: RTP, UDP, IP, ICMP, ARP, IGMPv2/v3, IPv6 DiffServ/ TOS, 802.1Q (VLAN tag), 802.1P (VLAN priority), IPP-2
- **FEC**: Compliant to SMPTE 2022-1/2
- **Extended FEC**: Support for extended matrix size (L*D < 960, max sum 244, e.g. 240 x 4)
- **SMPTE ST 2002-7**: Seamless IP protection Switching (SPS) - SMPTE ST 2002-7:2013
- **LDO**: Launch delay offset for network redundancy using single path and SMPTE 2022-7 (SPS)
- **Integrated frame store and refsync for robust operation**
- **IP jitter compensation for robust operation in the presence of IP transport impairments**
- **Test image transmission on sync loss for link preservation**

Monitoring

- **ETSI TR 101290 Priority 1 alarms (option for Pri 2)**
- **Thumbnails for confidence monitoring**
- **Detailed alarm log with 100,000 entries**
Nevion Virtuoso

Nevion Virtuoso is our latest generation of Media Node platform fulfilling the highest requirements of broadcasters and service providers. Virtuoso is designed to meet the challenges of an IP-based live production environment where the distinction between facilities and contribution is blurring, and where virtualization will play an increasing role, leading to faster time-to-production and greater cost-effectiveness.

Nevion Virtuoso is a comprehensive, flexible and scalable platform for real-time adaptation, transport and processing of live media content (video, audio and data) that provides tools for broadcasters and service providers to implement and operate state of the art media production systems. IP adaption, compression, protection, monitoring and aggregation are functionalities provided by Nevion Virtuoso. As an example, the platform is ideal for processing high quality media streams in a reliable manner with very low latency over network infrastructures with very high or constrained bandwidth capacity.