SONY

nevion

Virtuoso

Real-time media
transport and processing

April 2024

What is Virtuoso?

As viewers have more and more choice, distribution rights are skyrocketing and the pressure on the production efficiency is increasing, broadcasters and media organizations must be increasingly nimble to remain competitive. To achieve this, they need a real-time media transport, processing and monitoring solution that's highly versatile and adaptable.

Nevion Virtuoso is a standards-based, virtualization-ready, software-defined media node that can perform a variety of real-time functions for a wide range of applications including IP contribution and wide-area media transport, IP production facilities and converged LAN/WAN networks for remote & distributed production.

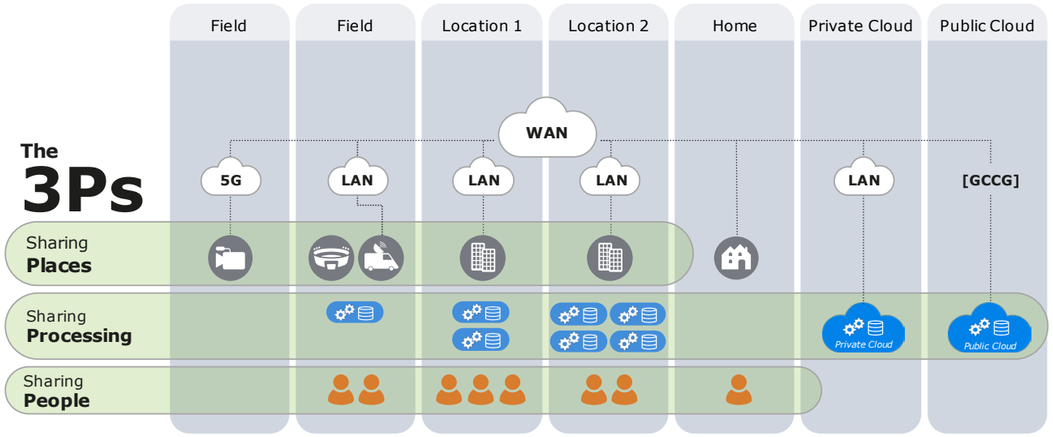
Live Production is changing

The future is distributed production

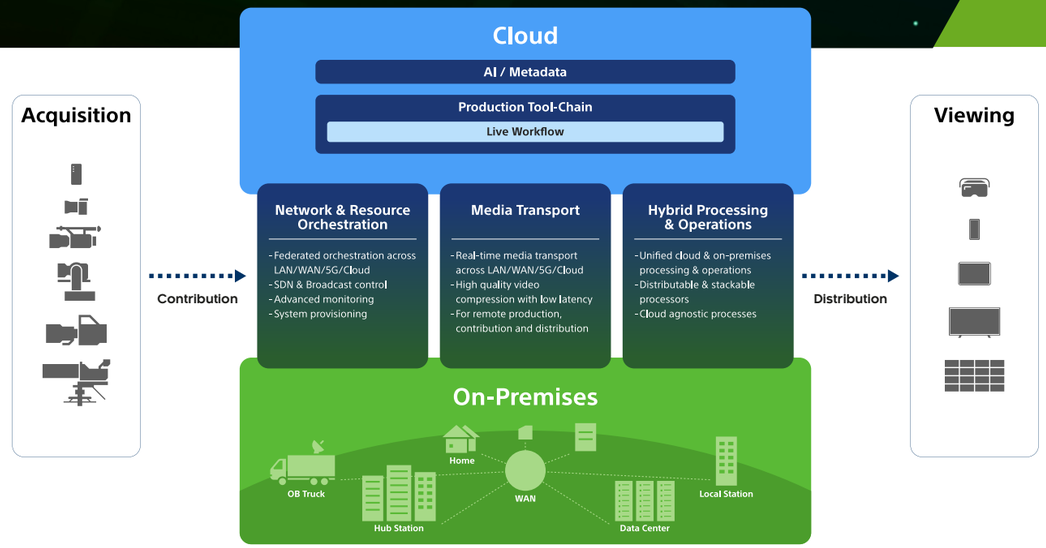
Content production is moving progressively towards a distributed model whereby workflows can tap into production resources almost anywhere on the ground and in the cloud. These production resources can be characterized by "the 3Ps":

- Places, such as studios, control rooms, OB production trucks, live venues.
- Processing, in other words all the tools that can manipulate media signals, including mixers, record and playback, video and audio processing.
- People, i.e. the production staff – The most important resource in a production.

Technology now allows all of these to contribute to the production regardless of their location.



This is transforming the logistics and economics of production, enabling multiple models for production, which can best suit medium/long term business needs and short-term production requirements.



NETWORKED LIVE

Networked Live is an ecosystem of solutions, products, services and partners that combines hybrid on-premises and cloud processing with network connectivity to transform the logistics and economics of high-quality mission critical live production.

Networked Live is based on 3 main pillars, supported by Sony's and Nevion's experience and expertise.

- Network and Resource Orchestration, including network orchestration, broadcast control, advance monitoring.
- Media Transport, i.e. the reliable real-time transport of video, audio and data over LAN, WAN, 5G and GCCG (ground-to-cloud-cloud-to-ground).
- Hybrid Processing and Operations, in short on-premises and cloud video and audio processing.

The Virtuoso software defined platform is a key component of both the Media Transport and Hybrid Processing & Operations pillars of Networked Live.

Where is Virtuoso used?

Nevion Virtuoso can be used for a variety of solutions and applications, including in the facilities, in outside broadcast trucks, for contribution, remote production and for cloud connectivity.

Facilities and OB-trucks (LAN)

In the facilities (studios, control rooms, MCR, etc) and OB-trucks, Virtuoso can perform a variety of media transport and processing functions. For example, it can be used to connect SDI, AES3, MADI and GPI equipment to the IP infrastructure (adaption) with support for conversion to/from SMPTE ST 2110 and control via NMOS. Virtuoso also provides video processing functions such as monitoring, de-interlacing, scaling, legalization, frame synchronization, delay, frame rate conversion and color space conversion. Virtuoso also offers a unique combination of audio processing such as audio monitoring, embedding, mixing, shuffling and control of polarity, gain and delay.

Contribution (WAN)

Virtuoso is commonly used to reliably transport signals over IP networks between locations, offering a variety of media transport and video encoding options (JPEG 2000, JPEG XS, TICO, and soon HEVC) for both HD and UHD formats. Virtuoso offers flexible video/audio/data interfacing options for SDI, digital/analog audio, ASI/TSoIP and IP (SMPTE ST 2110/2022) connectivity. In addition, the platform provides advanced protection and monitoring functionality to ensure reliable hand-off of signals both at ingress and egress.

Remote production (LAN/WAN)

In the context of remote production, all the capabilities applicable to the facilities, OB-truck and contribution apply. In addition, Virtuoso can protect the media edge (where WAN meets LAN) to ensure an optimum protection of the production capabilities. Virtuoso offers the flexibility to adapt to different remote production workflows and requirements like bandwidth, sync, latency, interfaces, etc.

Move to the cloud (Ground-to/from-Cloud)

Virtuoso provides the ability to transport signals fast, reliably and efficiently from the ground (e.g. facilities) to the cloud and from the cloud to the ground (GCCG), in particular using JPEG XS or HEVC video compression. This is a key requirement for the integration of cloud processing into live production workflows.

Why Virtuoso?

Today's live production calls for extremely versatile equipment that can evolve with needs, be it new media transport technologies or media processing capabilities.

Benefits

Virtuoso brings real benefits to production:

Proven

Thousands of Nevion Virtuoso units have been deployed globally, supporting the mission critical business of leading broadcasters and services providers, including most of the high-profile sports events across the world.

Versatile

Virtuoso has a broad range of capabilities that is continuously being added to through software updates and can be used in a wide variety of situations. This means greater versatility, quicker time-to-production and enhanced cost-effectiveness.

High-density

Virtuoso supports up to eight FPGA-powered media accelerator cards, making it one of the densest media transport and processing platforms available on the market.

Quality

High quality media transport, for both video and audio has always been a hallmark of Nevion, in particular with its best-in-class video compression codecs. Extensive protection mechanisms combined with in-depth monitoring ensures the highest quality of service for IP media transport.

The audio and video processing capabilities of Virtuoso are also focused on quality, including the ability to handle jitter and packet re-ordering.

Reliability

Virtuoso is designed to offer the highest level of reliability, for both broadcasting and telco applications. In particular, the carrier-grade version of Virtuoso offers modularity, hot-swap design, redundant backplane, element manager and power supplies to provide unprecedented up-time.

Secure

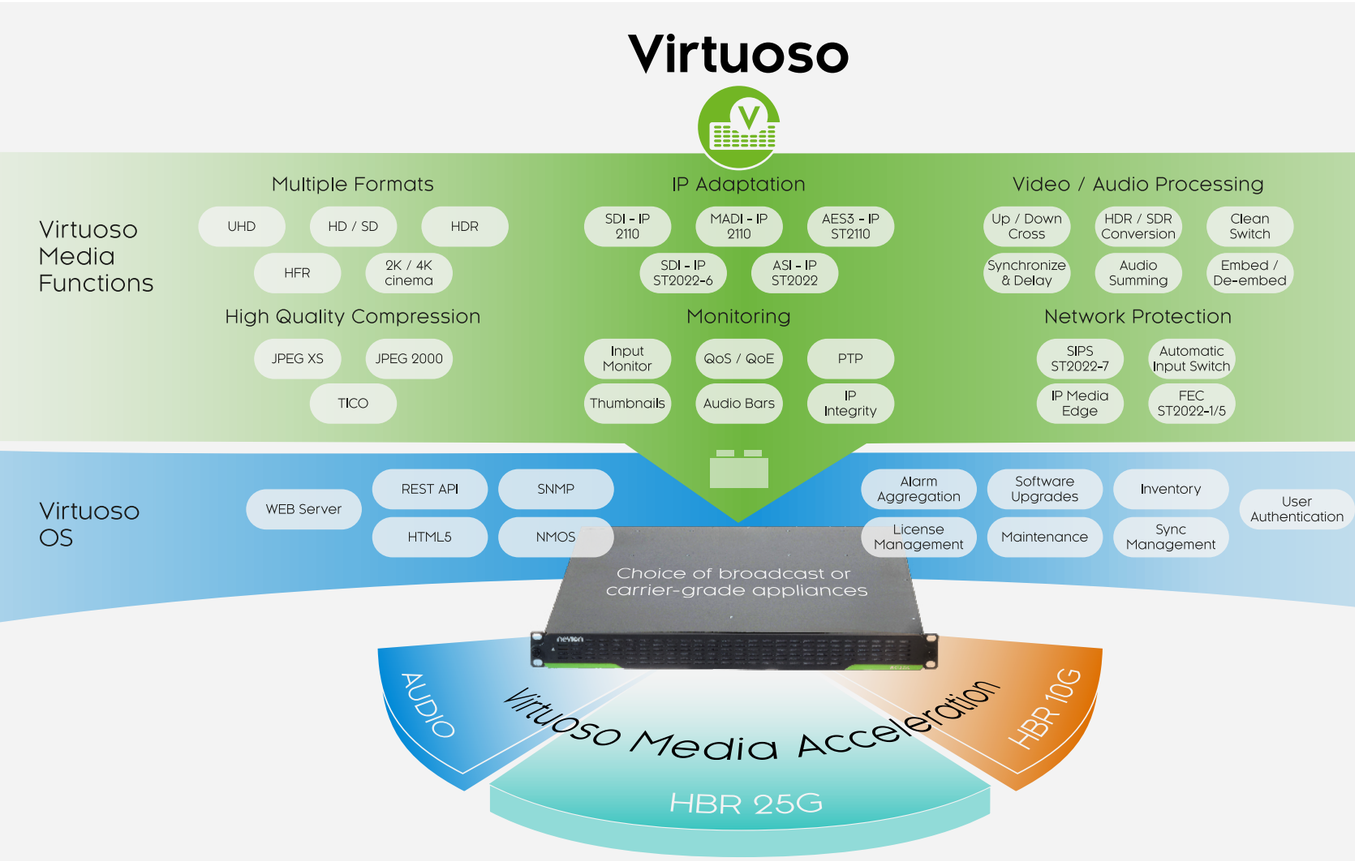
By design the Virtuoso platform provides users with peace of mind when connected to modern IP networks. Management and network interfaces can be protected through the use of the secure protocols, trust boundaries (IPME) and adhering to the latest industry recommendations on security.

Future-orientated

Through its software-defined architecture and functionality, its compliance to industry standards and its tested interoperability, Virtuoso is a platform that will evolve and grow to meet changing needs.

Features and functionality

Virtuoso's functionality is virtualized, and delivered by software modules known as Media Functions – all designed to perform with ultra-low latency. These licensed-enabled functions can be installed, activated and changed on demand – meaning there is no need to switch equipment when a change of functionality is required. Most of the Media Functions run on generic Media Accelerator cards, which are housed in a Media Appliance. Accelerator cards provide the required processing resources for Media Functions ranging from IP adaption and compression to advanced video/audio processing.



Standards-based

Sony and Nevion are actively involved in the development, adoption and promotion of open standards by established industry bodies (e.g. AMWA, SMPTE, VSF, AIMS). Virtuoso is built on those standards and has proven interoperability both through regular industry interoperability tests (e.g. JT-NM) and many live deployments.

Integrated with Networked Live

Virtuoso comes with a tight integration with other Networked Live products from Sony and Nevion, such as the Nevion VideoIPath Media Orchestration Platform. This reduces the cost of integration and time taken to deploy solutions.

At the same time, Virtuoso is based on industry standards and can therefore interact with products from other vendors giving our customers complete freedom of choice.

Virtuoso platform

The Nevion Virtuoso platform concept has been designed to allow for the provision of Media Appliances with different characteristics, such as size, number of Media Accelerator cards that can be accommodated and level of modularity and redundancy, to fit any deployment scenario.

Virtuoso MI media appliance

Nevion Virtuoso MI is a carrier-grade 1RU modular platform with dual AC load-sharing power supplies, supporting hot-swap and full internal redundancy for element management and control, high speed internal communication and timing/sync distribution. Nevion Virtuoso MI holds up to 8 Media Accelerator cards.

Virtuoso RE media appliance

Nevion Virtuoso RE is a compact 1RU media node targeted to broadcast applications. With dual AC load-sharing power supplies, integrated element manager, a high-speed internal communication fabric and built-in timing/sync distribution. Nevion Virtuoso RE holds up to 6 Media Accelerator cards.

Virtuoso Element Manager

For day-to-day operations, the Nevion Virtuoso Element Manager offers an intuitive and easy to use HTML5 web user interface, a modern and open RESTful API, alarm management, alarm and event notification and logging.

Further, it manages the role-based access control, authentication and overall security of the platform, as well as timing/sync distribution with built-in PTP best clock selection. The ease-of-use simplifies operations and allows for fast reconfiguration for occasional use applications.

Generic Media Accelerator cards

Nevion Virtuoso Media Accelerator cards are designed to provide optimum performance for software defined Media Functions, providing general compute/storage/networking and high-performance FPGA acceleration. SFP-based interfacing allows flexible connectivity to 1G, 10G or 25G Ethernet, optical and electrical SDI video up to 12G/UHD and MADI audio signals.

Analog and digital audio

While IP based audio (AES67, SMPTE ST 2110-30) is handled natively on the HBR Media Accelerator cards, analog audio as well as balanced/unbalanced digital AES3 is handled via special adapter cards and breakout panels to facilitate higher density audio interconnects.

The AES3 Digital Audio Card is designed for AES3 digital audio interfacing, while the RPRO Audio Card is designed for a mix of AES3 digital audio, analog audio and GPIO. The RPRO card in addition can generate legacy video and audio sync signals using the Virtuoso PTP-locked system clock as reference.

Network aggregation up to 100G

Virtuoso supports internal service routing and aggregation of video, audio and MPEG Transport Streams (see Generic Media Accelerator Cards).

The 100G interface is provided by the Virtuoso UplinX add-on, which is designed to aggregate IP streams from up to 6 Virtuoso MI or 8 Virtuoso RE appliances (up to 192 video signals in both directions). More cost-effective than in-appliance interfaces or a dedicated IP switch, Virtuoso UplinX is a highly flexible and scalable solution, with a choice of 2, 4 or 8 100G interfaces to fit the requirements of the specific deployment. Virtuoso UplinX allows customers to move to 100G (and in time even to 400G), without the need to upgrade their Virtuoso appliances or disrupt their configurations.

If data aggregation is required, a further option is to use Nevion eMerge IP SDN Media Fabric.

Management and orchestration

Virtuoso offers its own HTML5-based web-interface, to enable it to be configured and monitored.

Virtuoso is also closely integrated with Nevion's media orchestration platform, enabling multi-unit field deployments to be managed centrally. VideoIPath can manage Media Functions on those appliances, change software configurations or update to the latest available functionality. It can also collect and present monitoring information generated by the appliances.

IP adaption

With production workflows becoming more distributed, broadcasters have the need to transport more media content with high quality and high reliability over Wide Area Networks through high density solutions. Nevion Virtuoso can serve as the Swiss army knife for media transport across WAN and LAN networks.

SDI over IP, using SMPTE ST 2110

The SMPTE ST 2110 Media Function supports adaptation, synchronization and processing of uncompressed video and audio signals. The software supports up to four channels of bidirectional conversion, per accelerator, between between baseband 3G/HD/SD-SDI and SMPTE ST 2110 IP, with flexible audio processing and routing, PTP/SMPTE ST 2059 frame synchronization and delay management.

SDI over IP, using SMPTE ST 2110 UHD

Nevion Virtuoso's SDI-IP UHD SMPTE ST 2110 Media Function offers a powerful set of video and audio adaptation and processing functions for use in live IP production applications, supporting 12G-SDI and SMPTE ST 2110 over 25G infrastructure. The software supports dual channel conversion, per accelerator, between between 12G/3G/HD-SDI and SMPTE ST 2110, with built-in frame synchronization and flexible audio routing/shuffling, gain and delay processing.

SDI over IP, usingSMPTE ST 2022-6

The SDI-IP SMPTE ST 2022 Media Function enables reliable adaptation and transport of SD, HD and 3G-SDI signals over IP without any quality degradation.

For wide-area contribution applications, the software supports adaptation of baseband SDI signals to IP according to SMPTE ST 2022-6.

For adaptation in IP-based MCR or production environments, the software includes a built-in frame synchronizer with PTP/SMPTE ST 2059 support and audio embedding/de-embedding to AES67 and SMPTE ST 2110-30/31 IP audio.

ASI and TS over IP Gateway

Nevion Virtuoso's ASI and TS over IP Media Functions provides high density ASI-IP adaption, Transport Stream monitoring and redundancy switching.

The ASI Media Function runs on the Virtuoso HBR accelerator card providing up to 8 ASI inputs and 8 ASI outputs. Transport Streams are routed to/from an Uplink HBR card in Virtuoso that provides high density IP aggregation.

Audio over IP

Nevion Virtuoso's Audio Processor Media Function offers an attractive set of audio adaptation, processing and mixing functions for use in contribution, remote production and live audio production applications.

The audio processor Media Function provides conversion of two bidirectional optical MADI signals to/from AES67 / SMPTE 2110-30/31 audio.

The AES3 digital audio adaptor card and Media Function provides additional AES3 interfacing capability, while the RPRO adaptor card provides interfacing to a mix of digital and analog audio signals.

Nevion Virtuoso can serve as the Swiss army knife for media transport across WAN and LAN networks

Nevion Virtuoso
offers a variety of compression capabilities (CODECs), to suit different compression ratio, latency and multi-generational requirements

Compression

While IP and fiber connectivity and bandwidth is ever improving, video compression can provide large cost-savings or enable a higher number of video feeds on the same links, while providing low end-to-end latency and excellent video quality. Nevion Virtuoso offers a variety of compression capabilities (CODECs), to suit different compression ratio, latency and multi-generational requirements.

HEVC UHD/HD encoder/decoder (NEW)

Nevion Virtuoso integrates Sony's ground-breaking low latency HEVC CODEC, which provides compression ratios of close to 1 to 200, with a latency of around seven frames. This capability is especially useful when bandwidth is limited.

JPEG-XS UHD/HD encoder/decoder

Nevion Virtuoso's JPEG XS UHD/HD Media Function offers multi-channel JPEG XS encoding or decoding with native SMPTE ST 2110 video or SDI baseband interfaces, with SMPTE ST 2110-22 compressed JPEG XS essence transport compatible with VSF TR-08.

JPEG XS (ISO/IEC 21122) is a modern light-weight image and video encoding standard that achieves pristine visually lossless video quality even for multiple concatenated compression cycles. The ultra low sub-millisecond (sub-frame) latency of JPEG XS encoding is a key benefit, and enables end-to-end delays of less than one video frame period. This makes JPEG XS extremely attractive for low latency real-time transport of HD and UHD/4K video over wide-area networks (WANs). It also makes it suitable for bandwidth-constrained campus and facility local area networks (LANs) when uncompressed transport is not a viable option.

JPEG XS in TS encoder/decoder (TR-07)

Nevion Virtuoso's JPEG XS in Transport Stream Media Functions offers multi-channel JPEG XS encoding or decoding for HD and UHD signals with SDI baseband or SMPTE ST 2110 IP interfaces, with multiplexed MPEG TS (SMPTE ST 2022-1/2/7) transport over IP compatible with VSF TR-07.

Nevion Virtuoso can run multiple instances of the JPEG XS in TS Media Function on a single platform with built-in network aggregation.

A single JPEG XS instance supports encoding or decoding of up to 4 HD or 2 UHD signals, providing up to 28 HD channel or 14 UHD channel encoding/decoding in the Virtuoso MI platform.

Video/audio processing

Nevion's Virtuoso provides video and audio processing functions that are essential for live production applications, whether it's a live event outside broadcast (e.g. with OB-trucks) or centralized glue or processing infrastructure for studios, production control rooms or master control rooms.

The versatility, performance and low latency makes Virtuoso the ideal platform for live broadcast and media production applications.

JPEG-2000 HD/UHD encoder/decoder

Nevion Virtuoso's JPEG 2000 Media Function saves bandwidth while providing visually lossless compressed video, transparent audio and data, at ultra-low latency.

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 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.

JPEG-2000 DCI encoder/decoder

Using JPEG 2000 encoding and decoding, Nevion's Virtuoso allows film studios and production companies to share pristine-looking content in real-time across the world, improving cooperation and production workflows.

The Virtuoso JPEG 2000 DCI (Digital Cinema Initiative) low-latency encoding and transport solution provides visually lossless video quality, full-color fidelity and accuracy while using a fraction of the bandwidth of uncompressed transport.

TICO UHD encoder/decoder

The Virtuoso TICO UHD Media Function provides visually lossless lightweight 4:1 compression for the transport of UHD and 4K signals with sub-frame latency.

The Nevion TICO UHD Media Function enables cost-effective transport of 12 Gb/s 4K/UHD video over 10G IP networks using SMPTE ST 2022-6/7 or over existing 3G-SDI infrastructure.

Up/Down/Cross Media Function

Nevion Virtuoso's Up/Down/Cross (UDC) Media Function offers a variety of high-quality format conversions for HD and UHD with native SMPTE ST 2110-20 uncompressed video in/out on 25G interfaces.

A single Up/Down/Cross instance running on an HBR25 card in Virtuoso MI supports two independent video converters. Each converter can perform de-interlacing, scaling, 3D LUT colour conversion, HDR/SDR conversion, legalization, frame synchronization and delay. Any-to-any conversion is supported for HD 720p, 1080i, 1080p and UHD 2160p video formats.

Audio processor Media Function

Nevion Virtuoso's Audio Processor Media Function (AUD-PROC-MADI-IP) offers an attractive set of audio adaptation, processing and mixing functions for use in live audio production applications.

The AUD-PROC-MADI Media Function provides bidirectional MADI and SMPTE ST 2110/AES67 IP audio interfacing, monitoring, routing and processing of audio signals.

Four audio processor engines, each with 64 output channels, are available for flexible routing/mono shuffling and per-channel control of polarity, gain and delay. Each of the processing engines can also be configured as an audio summing matrix mixer with up to 512 cross-points.

Separate adapter cards and breakout cables are available for unbalanced/balanced AES3 and analog audio interfacing.

IP Media Trust Boundaries

Virtuoso's IP Media Edge (IPME) functionality is a key addition to the platform, focused entirely on processing IP media flows to secure networks and optimize their performance. While the original implementation of IPME predates SMPTE RP 2129 "Trust Boundary" proposal by some years (underlying Nevion's pioneering leadership in this matter), it adheres to its recommendations.

The IPME capability is ideal for protecting the media network edge (e.g. where LAN meets WAN), thanks to its dedicated hardware packet processing and complete isolation between ethernet ports.

IP Media Edge Media Function

Nevion Virtuoso's IP Media Edge Processor offers network isolation, media firewall, network stream protection and translation for UDP and RTP IP media flows.

The IP Media Edge (IPME) Processor incorporates advanced techniques for processing and protection of RTP/UDP/IP media flows.

Processing features include Network Address Translation (NAT), bitrate policing, stream duplication, flow linearization / de-jittering and UDP/IP to RTP/UDP/IP conversion.

Protection features include SMPTE ST 2022-7 hitless switching for RTP stream redundancy and SMPTE ST 2022-1/5 Forward Error Correction.

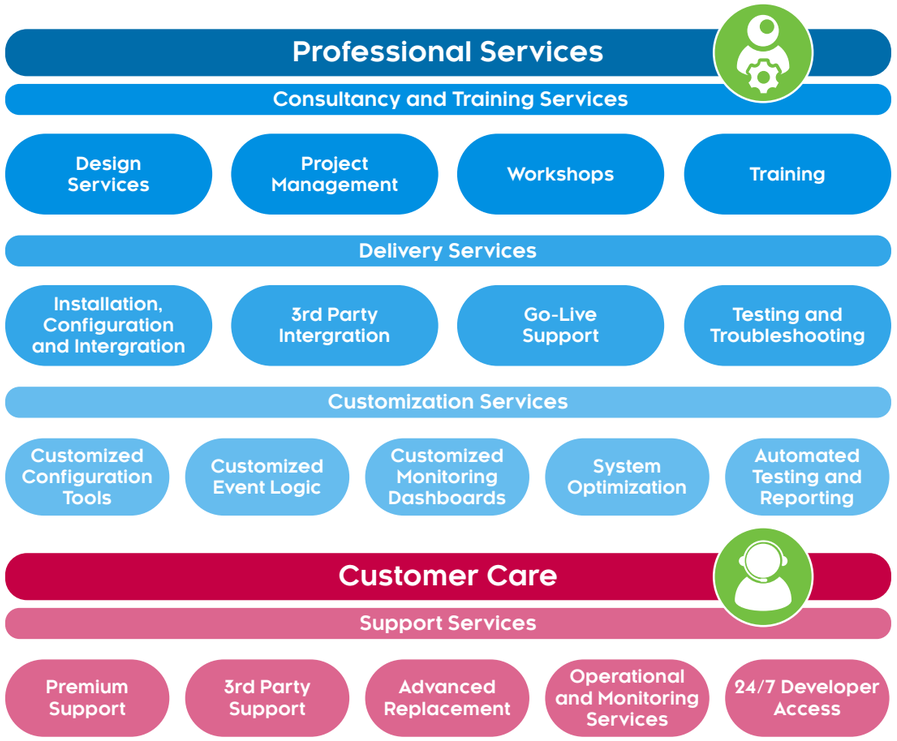
Services

Sony and Nevion provide an extensive portfolio of services before, during and after product or project delivery.

Specifically relating to Virtuoso, Nevion's services include:

- **Configuration**, i.e. setting up the appliances with the correct media accelerator cards and the required media functions
- **System testing**, prior to shipping and onsite, stand-alone and in the context of the complete system deployment
- **Training** on the devices and their specific deployment
- **Commissioning** of the Virtuosos and the complete solution
- **Active monitoring and reporting** of the appliances within the solution
- **Support**, such as answering questions and concerns, solving issues, upgrading software versions, etc.

And much more...



For a full overview of the support offered by Nevion, visit

nevion.com/services

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