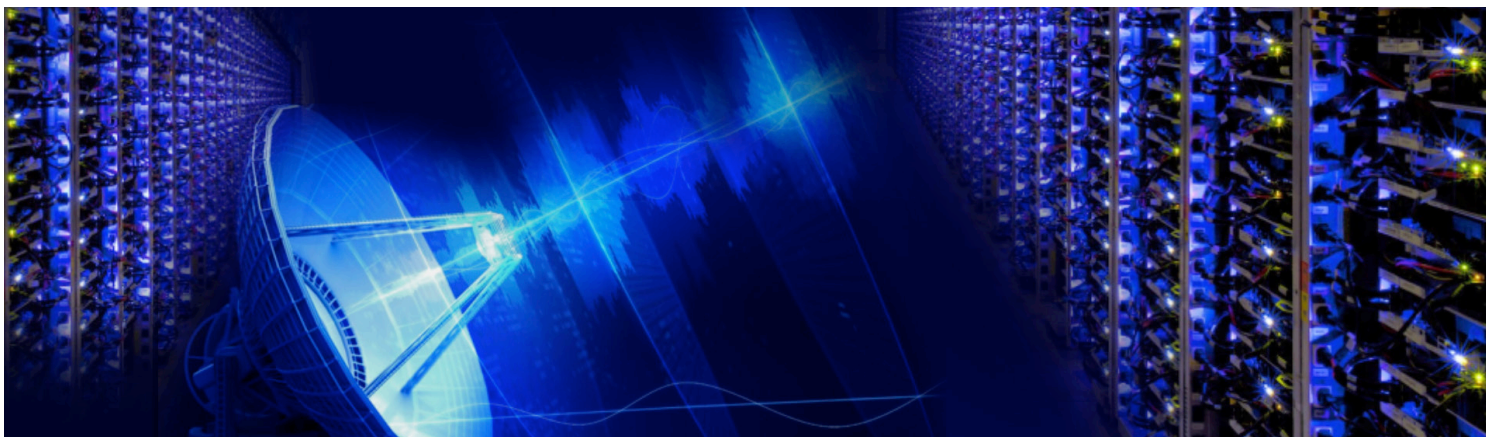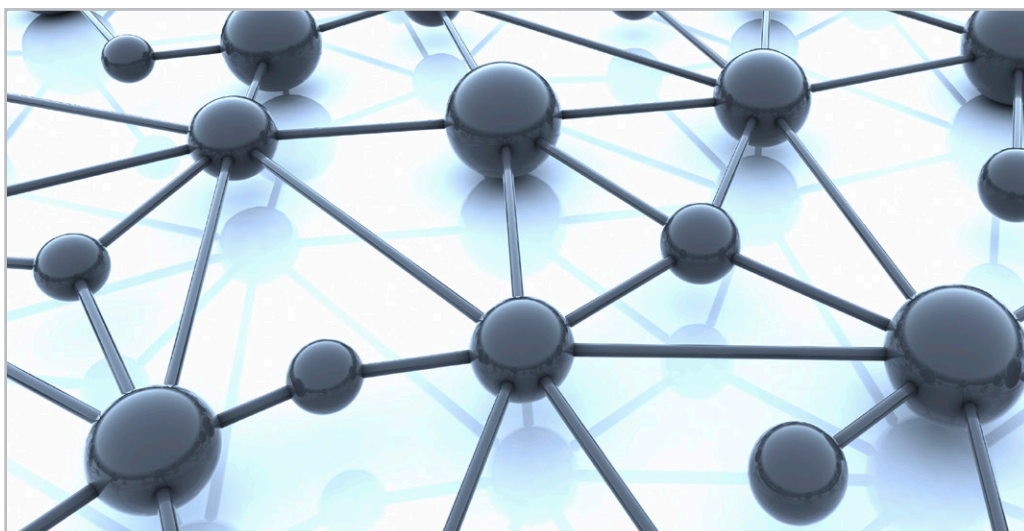# GV Node

The world's first true real time IP processing and routing platform

IP

TICO

GV Node delivers a broadcast-centric, real-time, distributed routing and IP processing node that supports IP and SDI workflows with vertically accurate switching and integrated video and audio processing, including Kaleido multiviewing for live production, playout and general purpose infrastructure.

Up until now, there has not been an IP aggregation, processing and edge routing node designed for live production in broadcast, which can offer vertically accurate switching along with other signal processing and routing capability. With the introduction of GV Node by Grass Valley, a Belden Brand, common off-the-shelf (COTS) IP switches can be used in broadcast and media facilities with the assurance that these switches offer transparent broadcast-centric operation and processing.

GV Node is designed to handle deterministic vertically accurate switching within IP, supporting the suite of SMPTE ST 2110 or 2022-6 for IP inputs and outputs, with the option to provide Class-D ultra low latency SMPTE ST 2022-7 redundancy. The addition of isochronous and asynchronous support in SMPTE ST 2022-6 workflows provides a robust capacity to manage source timing variances. For full broadcast capabilities, GV Node also supports TICO visually lossless compression for 4K UHD applications, the extensive range of Densité signal processing modules, along with a fully integrated and highly scalable Kaleido multiviewer to deliver the highest quality monitoring with the most flexible layout available.

Vertically Accurate Switching

One of the most important differentiators of GV Node to other proprietary and COTS IP switching solutions available to broadcasters is its vertically accurate, deterministic switching capability. This is critical because broadcasters have valid concerns about the effectiveness of COTS IP switches for some live applications, due to their inability to perform switching in the vertical interval like traditional SDI routers. This is especially important in live applications where signals go directly to air, and where routers have traditionally been used as a back-up to the production switcher. Vertically accurate switching is also needed when a router is used for providing secondary live feeds.
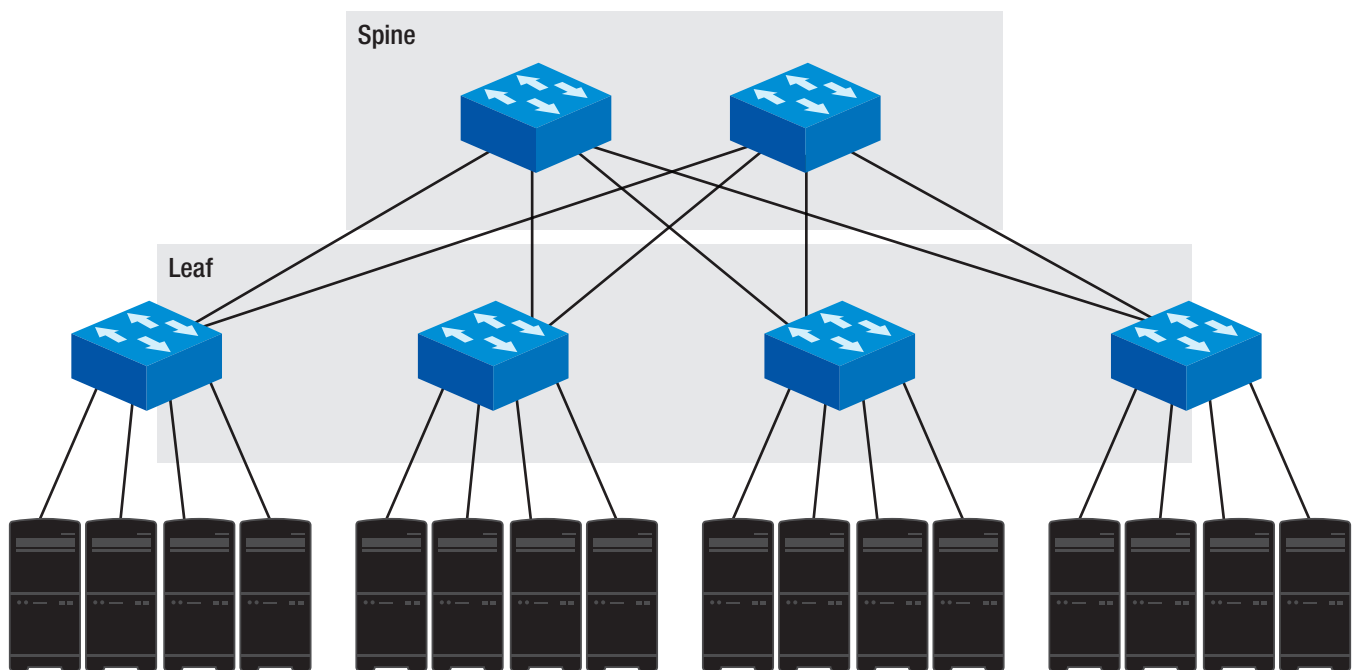
GV Node enables highly scalable, distributed topologies which leverage COTS IP switches in combination with a "spine-leaf" architecture (also known as a distributed core) that's typical of modern IT infrastructures. This topology represents a much more scalable and flexible approach than traditional, centralized routing systems, which forces the purchase of larger, more expensive chassis than are actually necessary in order to preserve the potential for future expansion.

What makes a spine-leaf architecture so unique is that every leaf switch connects to every spine switch. In this way, no matter which leaf switch a piece of equipment is connected to, it crosses the same number of devices to get to another piece of equipment (unless both are connected to the same leaf). This keeps the latency to a minimum and predictable level as the IP-based data only has to hop to a spine switch and another leaf switch to get to its destination.
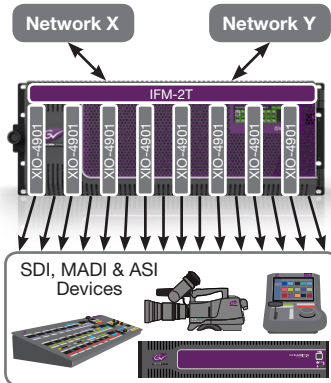
Quiet Audio Switching

Another broadcast feature built into the GV Node is quiet audio switching, which COTS switches are not yet able to provide. The ability to V-fade audio removes the presence of unpleasant "pops" when audio channels are switched. By using GV Node alongside COTS switches, quiet audio transitions can be assured.

A small-scale spine-leaf architecture as used in typical IP infrastructures

Spine

Leaf

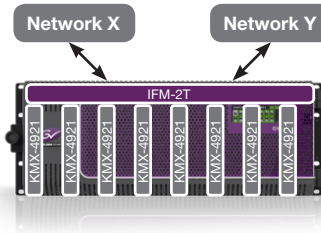## GV Node The world's first true real time IP processing and routing platform

Multiple GV Node IP routing and processing nodes can be readily connected to a COTS switch, using a mix of I/Os to create large and flexible monitoring, switching and processing systems. GV Node can be added to both existing facilities as a "top of rack" expansion, and as a scalable standalone system that can grow as your needs increase, and as new technologies become available.

Use Case – GV Node Edge Routing

- Optional redundant core IP network
- IP Multicast routing
- IGMP Join/Leave switching
- IGMP Joins via Router Control System
- Clean & quiet transitions
- Legacy devices converted to/ from IP
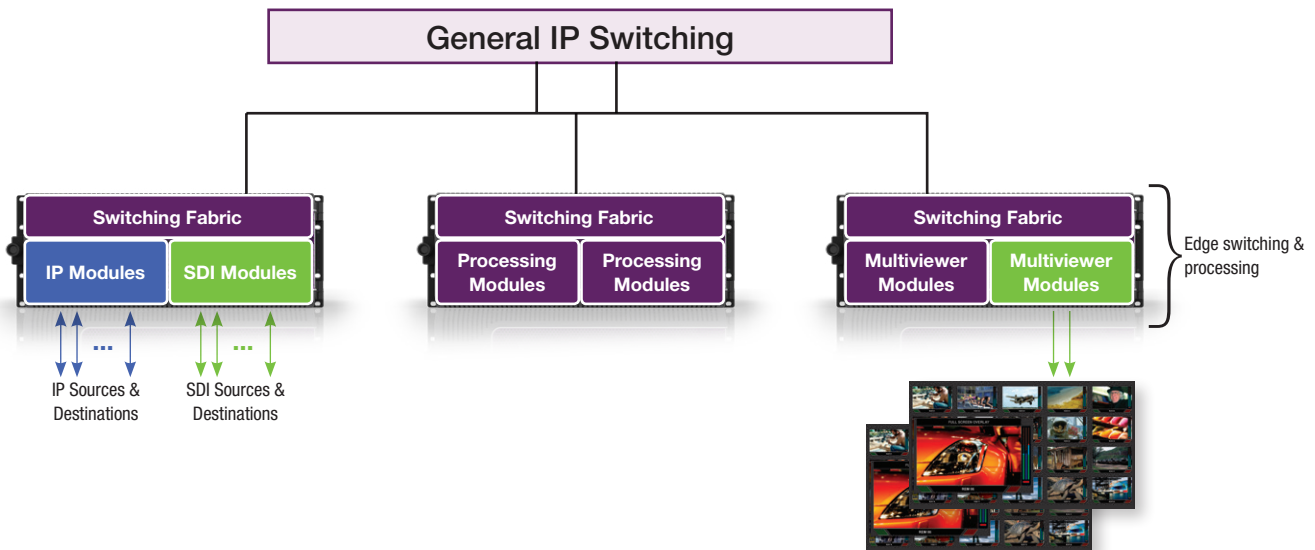
Use Case – GV Node IP Processing

- Optional redundant core IP network
- IP Multicast routing
- IGMP Join/Leave switching
- IGMP Joins via Router Control System
- Clean & quiet transitions
- All IP I/O
- Addressable pool of processing resources

Broadcast Data Center: Streamlined Switching & Processing

The diagram shows General IP Switching at top connecting to three Switching Fabric boxes. First has IP Modules and SDI Modules, second has Processing Modules and Processing Modules, third has Multiviewer Modules and Multiviewer Modules.

General IP Switching

Switching Fabric
- IP Modules
- SDI Modules

Switching Fabric
- Processing Modules
- Processing Modules

Switching Fabric
- Multiviewer Modules
- Multiviewer Modules

Edge switching & processing

IP Sources & Destinations

SDI Sources & Destinations

Signal Processing

In addition to vertically accurate switching for SDI and IP I/Os (up to 144x144), GV Node also supports ASI and MADI I/O, AES67 audio de-embedding/embedding, and monitoring including multiviewing and signal probing. The built-in, high-quality, ultra-scalable multiviewer leverages industry-proven Kaleido technology which is known for its exceptional picture quality, layout flexibility and rich feature set, with options for HDR and WCG processing. The advanced monitoring capabilities and signal probing make GV Node ideal for production and playout applications.

With its vast processing capability to manage synchronous, asynchronous and isochronous signals, GV Node transforms COTS IP switches into cost-effective broadcast-centric switches with all the routing and signal processing capability that is available in today's SDI-based routing switchers and signal processing modules.

Simplify Routing & Reduce Cabling

As GV Node's signal management and monitoring uses a spine-leaf distributed architecture, including signal aggregation, you not only boost scalability but also simplify and minimize cabling as well. A single 4 RU frame can aggregate up to 288 video signals over twelve (12) 40 GigE connections.

GV Node's distributed, scalable architecture means that small IP infrastructure islands are able to grow quickly and linearly as requirements expand by adding additional nodes and switches. This flexible infrastructure supports single or multiple GV Nodes distributed within fully connected mesh topologies for large productions.

By adding COTS IP switching at the core and using GV Node as edge devices, topologies can easily reach extreme capacities of 10,000x10,000 video signals. And there's no need to constantly replace hardware as technology and requirements change. Plus, you benefit from agile deployment of processing resources based on centralized data center topology.

The exceptional functional integration of GV Node can streamline your infrastructure by minimizing the number of devices, resulting in less space, weight, power and cabling.

Traditional SDI Routing vs IP Switch Routing

Traditionally, broadcast infrastructures have been built around large SDI core routers, where every input and output is uniquely and explicitly connected. While this approach provides robust control, it also causes cabling complexity and can create heavy space, power and cooling requirements. All of the devices in the system are connected to the router using a cable for every input and/or output.

Another drawback to a traditional, large core router is inflexible scaling. Large core routers are typically available in sizes starting at around 144x144. Moving beyond this entry size requires either a doubling of the output capacity (144x144 becomes 144x288) or a doubling of both the input and output capacity (144x144 becomes 288x288). This doubling process continues as overall system size increases (288x288 becomes 576x576 and 576x576 becomes 1152x1152). The implication is that you must either overbuild (purchase a larger, more expensive chassis than necessary in order to allow for future expansion) or risk running out of capacity and abandoning your initial purchase.

In contrast, GV Node-based infrastructures are much easier to scale from small to large systems due to their distributed architecture, and they involve less cabling, with a lighter spine-leaf architecture. Importantly, IP also offers greater format flexibility for a transition to 4K UHD, 8K UHD and beyond.

A GV Node IP processing and routing node comprises the following elements:

- GV Node frame (4 RU) with 16 card slots which interface to an internal switch fabric that supports 9x9 3G-SDI and 288x288 audio channels for each card slot. High-speed aggregation ports (12x40 Gb/s QSFP+) offer interconnection with other chassis and switch fabric elements
- XIO-4901 coax SDI input/output module offers connections to legacy DIN/BNC-based SDI, ASI and MADI devices, and provides 9x9 SDI with audio mux/demux
- Compatible with NV9000, GV Convergent and other third-party router control systems

Optional I/O cards:

In addition to modular cards from the Densité product line, GV Node also offer cards with specialized functions.

- **IPG-4901 IP Gateway —** Leveraging the full SMPTE ST 2022-7 Class A specification to ensure uninterrupted reception of high jitter signals with multi-mode or single-mode SFPs from software-based transmitters and remote sources up to 40 km. When using SMPTE ST 2022-7 compliant sources, the IPG-4901 can align redundant sources which are out of synchronization. In conjunction with the GV Node 40G aggregation ports, the IPG-4901 can convert SMPTE ST 2022-6 and AES67 signals from the WAN to SMPTE ST 2110-20/30/40 signals on the LAN. Each IPG-4901 module supports up six 3 Gb/s sources or nine HD sources with AES67 audio de-embedding and embedding.
- **KMX-4921 Multiviewer —** Supporting the same features and specifications as the earlier KMX-4911, the KMX-4921 multiviewer is SMPTE ST 2110-20 and SMPTE ST 2022-6 compliant and adds processing of high dynamic range (HDR) and wide color gamut (WCG) sources in HLG, PQ and S-Log3 HDR formats, and BT.2020 WCG. Each input is individually configurable, which allows to mix and match SDR and HDR sources, as well as different formats of HDR, on the same display. Requires KMX-4921-OPT-HDR license.
- **Densité Signal Processing Modules —** May be added to a GV Node frame.

GV Node The world's first true real time IP processing and routing platform

KEY FEATURES

- Provides vertically accurate switching and IP aggregation of up to 144x144 SDI or IP video signals
- Quiet audio switching of 4608x4608 audio channels (2304x2304 for local and 2304x2304 for aggregation)
- Embedding and de-embedding of AES67 audio
- Highly distributed topology, based on "spine-leaf" architecture that's typical of modern IT infrastructures
- Industry proven built-in Kaleido multiviewer for high-quality picture and graphics monitoring
  - HDR-capable multiviewer that supports HLG, PQ and S-Log3 gamma, and BT.2020 color gamut
- Small 4 RU footprint, typically requiring 40% less rack space than competitive systems with comparable weight reduction
- 1 TB of IP bandwidth for signal aggregation

- Up to 16 I/O processing modules:
  - Backwards compatible with all existing Densité modular processing
  - Fully integrated 9x2 multiviewer module, expandable to 54x4
- Compatible with the large installed base of Densité signal processing modules for production in a box
- High level of functional integration across IP switching, IP/SDI gateway, audio processing and multiviewing
- Support for the suite of SMPTE ST 2110 and 2022-6 and TICO compression (4K UHD-capable, scalable to 8K x 8K with one hop). Provides option to safeguard multicast traffic with SMPTE ST 2022-7 Class-D Ultra Low Scale redundancy
- Functional integration provides superior performance delivering reduced delay, fewer components and a better user experience
- Processes asynchronous and isochronous signals, as well as signals from a WAN or software source with high jitter rates for clean switching

SPECIFICATIONS

Mechanical
Dimensions:
4 RU x 485 mm (19 in.) x 286 mm (11.25 in.) with connectors
Weight:
7.1 kg (15.7 lbs.), 1 PSU and 1 controller
~19.5 kg (~43 lbs.), fully populated (16 I/O or processing modules)

Power
Input range:
AC 50-60 Hz, 100-240 V
Rating:
700W

Control and Monitoring
Communication ports:
Dual Gigabit Ethernet
Alarm:
GPI contact

Cooling
Variable speed fans:
2 sets of 3 fans on the rear of the frame
1 on each PSU
Operating temp. range:
0°- 40° C (32°- 104° F)

ORDERING

GVN-FR4	4 RU GV Node frame. Includes GVN-CPU-ETH3 controller and two DENSITE 3+ FR4-PSU-AC
IFM-2T	Internal fabric module with 2 Tb switching capacity. For use with GV Node
IFM-2T-RP1	Internal fabric module rear panel with 40 GigE aggregation ports
IFM-2T-OPT-40G-6	License to enable SMPTE ST 2022-6 support on internal fabric module 40 GigE aggregation ports

I/Os – Copper	**Description**
XIO-4901	3G/HD/SD SDI input/output card with monitoring and de-embedding/embedding (optional SW license). For use with GV Node
XIO-4901-OPT-MDX	Audio embedding/de-embedding (software option)
XIO-4901-4SRP-D	Single rear panel with 18 DIN connectors

Multiviewer (integrated)	**Description**
KMX-4921-9X1	9x1 scalable Kaleido multiviewer for GV Node (SD/HD/3G SDI). Provides up to 9 PIPs over 1 display
KMX-4921-9X2	9x2 scalable Kaleido multiviewer for GV Node (SD/HD/3G SDI). Provides up to 9 PIPs over 2 displays, or 4 display when used with appropriate rear panel
KMX-49N1-9X2-4SRP	Single rear panel for optional SFP module
KMX-49N1-18X4-4DRP	Dual rear panel. Required for expanding two KMX-4911 or KMX-4921 cards to 18x1, 18x2 or 18x4 multiviewer to provide up to 18 PIPs over 1, 2 or 4 displays. Multiviewer SDI, HDMI or fiber outputs from the rear panel require SFP selection (optional)
KMX-49N1-27X4-4TRP	Triple rear panel. Required for expanding three KMX-4911 or KMX-4921 cards to 27x1, 27x2 or 27x4 multiviewer to provide up to 27 PIPs over 1, 2 or 4 displays. Multiviewer SDI, HDMI or fiber outputs from the rear panel require SFP selection (optional)
KMX-49N1-36X4-4QRP	Quadruple rear panel. Required for expanding four KMX-4911 or KMX-4921 cards to a 36x1, 36x2 or 36x4 multiviewer to provide up to 36 PIPs over 1, 2 or 4 displays. Multiviewer SDI, HDMI or fiber outputs from the rear panel require SFP selection (optional)
KMX-49N1-54X4-4HRP	Six slot rear panel with dual SFP slots. Required for expanding four KMX-4911 or KMX-4921 cards to a 54x1, 54x2 or 54x4 multiviewer to provide up to 54 PIPs over 1, 2 or 4 displays. SDI, HDMI or fiber outputs from the rear panel require SFP selection (optional)
SFP-3G-2OUT-L	Dual HD/3G SDI long reach output SFP with DIN connector
SFP-HDMI-OUT	Single HDMI type D output SFP
HDMI-D-A-2	HDMI type D to type A cable with retention lock (2m)
SFP-T-S13-LC	Single Tx fiber module at 1310 nm with LC connector
SFP-TT-S13S13-LC	Dual fiber Tx (output) cartridge at 1310 nm with LC/PC connector
SFP-TT-W13W15-LC	Single fiber Dual Tx Cartridge at 1310 & 1550 nm with WDM LC/PC connector
KMX-49N1-OPT-CSX	CC/Subtitling and XDS data license for KMX-4911 or KMX-4921 (1/card)

KMX-49N1-OPT-DOLBY	License for extraction of Dolby-E Metadata for KMX-4911 or KMX-4921 (1/card)
KMX-49N1-OPT-OP2	Second head output enable license for KMX-4911-9X1 or KMX-4921-9X1 (1/card)
KMX-49N1-OPT-ROT	Output rotation license for portrait display orientation for KMX-4911-9X1 or KMX-4921-9X1 (1/card)
KMX-49N1-OPT-SCTE	License for extraction of SCTE-104 metadata for KMX-4911 or KMX-4921 (1/card)
KMX-4921-OPT-HDR*	License for HDR input processing for KMX-4921 (1/card)
KMX-49N1-OPT-LOUD	Loudness level measurement license for KMX-4911 or KMX-4921 (1/card)

Software options are required for every card in a multiple card configuration: 18x4, 27x4, 36x4 or 54x4

High Density Fiber IP Gateway for GV Node (integrated)	
IPG-4901	High Density Fiber IP Gateway for GV Node
IPG-4901-4SRP	Single Rear connector panel for GV Node
SFP Options:	
SFP-ETH10G-RT-S13-LC	Optical 10 GigE cartridge, single-mode 1310 nm, LC/PC connector, 10 km (6.2 mi.)
SFP-ETH10G-RT-M85-LC	Optical 10 GigE cartridge, multi-mode 850 nm, LC/PC connector, 300m (984 ft.)
QSFP-SFP-CBL-5MM1	AOC Splitter 5m multi-mode fiber QSFP+ to 4x SFP+

Note: One or two SFP options must be ordered for each IPG-4901.

Other types of SFP Optical are available for this product. Please contact your local Grass Valley sales representative for more information.

Remote control: iControl or iControl Solo (version 7.10 or higher required), GV Convergent

Cables (copper & fiber)	**Description**
QSFP-CBL-1MM	1m multi-mode fiber QSFP+ cable
QSFP-CBL-5MM	5m multi-mode fiber QSFP+ cable
QSFP-SFP-CBL-5MM1	AOC Splitter 5m multi-mode fiber QSFP+ to 4x SFP+

Optical Cartridges	**Description**
QSFP-40G-SR4	40GBASE-SR4, 850 nm, 1x12 MPO
QSFP-40G-ESR4	40GBASE-SR4, 850 nm, 1x12 MPO, ext. range

In addition to the new modules outlined above, GV Node can be fitted with existing Densité 3 RU/2 RU modules to provide a wide range of SDI processing capabilities.

Multiple control options for the GV Node IP processing node include GV Convergent, NV9000, iControl or the RCP-200 panel.

* Check for availability

GV Node Services – Defining, Deploying and Supporting Solutions for the Migration to an IP Infrastructure

The performance of a broadcast enterprise can't be impacted by any interruptions, including technological glitches, workflow inefficiencies or mistakes caused by insufficient training.

That's why Grass Valley Global Services offers a full spectrum of Professional Services, Training and comprehensive Customer Support, which ensures successful ownership and operation of Grass Valley solutions.

With advanced architectural services, proven methodologies, preventative support and priority response, your operations are optimized and maximized, so broadcast environments run leaner, smoother and more aligned with business priorities.

Professional Services

Define, design and deploy solutions that meet business goals. When partnering with Grass Valley Professional Services, a team of experts comes along as part of the interaction. From initial concept and architecture definition, to implementation and management, they will help realize solutions that address the unique processes, workflows and infrastructure requirements necessary to meet business objectives.

Enhance the quantity and quality of organizational resources. Meet and exceed end-to-end project requirements that ensure getting it right the first time.

Ensure productive workflows and operational efficiencies are in place and designs maximize available budget. Gain increased productivity leading to a measurable quicker return on investment.

Migrate workflows off legacy systems to new architectures. Enjoy the advantages of new technologies.

Move swiftly from purchase to production. Accelerate the steps from build — to integrate — to operate.
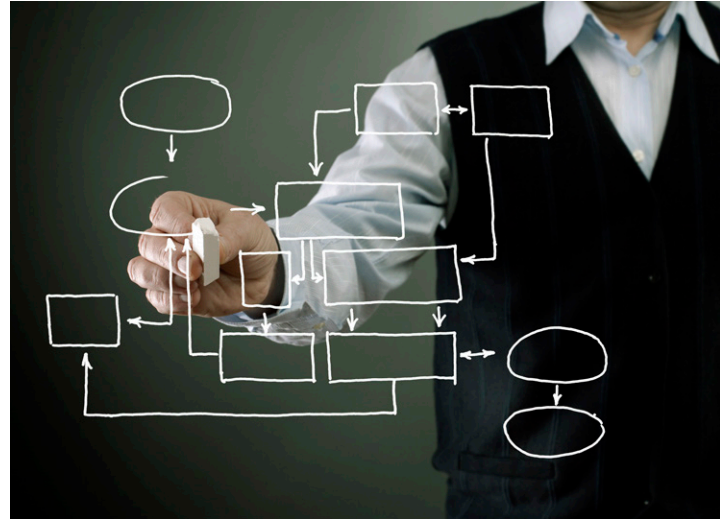
Commissioning

Grass Valley insures the best use of GV Node-based systems by personally handling the initial setup and commissioning. Field engineers have the experience, knowledge and skills necessary to bring a variety of systems to life—both as product sets, and in the broader context of complete solutions.

Training

Get maximum value from Grass Valley solutions. With on-site, online, factory-based and customized education, your organization gains the knowledge and skills to meet its operational and technical support needs. Expert-led courses are designed for operators and maintenance engineers, with a combination of theoretical learning and hands-on exercises.

Support Agreements

Get ahead of the game and take proactive steps to support all operational aspects. With Grass Valley Customer Support, investments are protected, uptime requirements are met and system performance is maintained and enhanced. Elite, Basic and Custom Agreements are straightforward and easy-to-understand.

The Elite Support Agreement is designed for critical environments where uptime is demanded and rapid problem resolution is a must. This agreement provides 24x7 technical phone support, call center prioritization, service level commitments, defined fault resolution processes, free software updates and upgrades and advance parts exchange. With an Elite Support Agreement, media production environments achieve both operational efficiency and financial predictability.

GLOBAL SERVICES PROVIDES:

- Unequalled depth of industry knowledge and technical expertise
- Over 50 years of worldwide experience
- Complete set of services:
  - Strategic advice
  - System architecture
  - Workflow analysis and design
  - Project management
  - Integration and implementation
  - Performance optimization
  - Technical and operational training
  - Educational services
- Address today's challenges and prepare for tomorrow's opportunities

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