RGB'S VMG

RGB Video Multiprocessing Gateway

The world's first scalable, carrier-class IP video platform for Multiscreen Delivery

VMG GEN1 BENEFITS INCLUDE:

- High stream processing and capacity
- High density, allowing for pay-as-you-grow scalability, without compromising on pristine video quality
- High-availability, carrier-class platform with multi-level redundancy and unmatched reliability
- FPGAs, ASICs and Intel processors ensure best-in-class implementation
- Multi-processor architecture offers future-proofing for new applications, while achieving the greatest density/cost benefits for proven functions
- Ultra-dense platform conserves rack space and reduces power requirements.

RGB's Video Multiprocessing Gateway (VMG) product line offers the industry's first high-density, carrier-class platform for the delivery of advanced video services, including high definition (HD) and standard definition (SD) video, as well as multi-resolution MPEG-4/H.264 and MPEG-2 video streams. The VMG Gen1 is an integrated solution specifically designed to address a number of critical applications, including advanced ad insertion, transrating, transcoding and re-coding, in a highly integrated and flexible configuration. The VMG's modular blade architecture represents a future-proof investment that scales well in the rapidly-evolving video marketplace.

RGB's carrier-class Video Multiprocessing Gateway (VMG) is the ideal platform for operators seeking to accelerate the growth and profitability of their video services in the most cost-effective manner. With the VMG, telecom, cable and other operators can concurrently deliver MPEG-2 and MPEG-4/H.264 digital broadcast or on-demand video services targeting a variety of consumer video devices.

The flexibility of the VMG allows it to be used for the implementation of a variety of applications critical to the success of today's operators. In the core of the network (or super headend), centralized functions are performed in the areas of transcoding, grooming, national/regional ad insertion and program substitution. Edge-level deployment allows for local content transcoding, grooming, local/zoned ad insertion and program substitution, as well as statistical multiplexing and transrating for optimal downstream delivery.

CONTENT REPURPOSING

With MPEG-4/H.264 now permeating all facets of 'large screen' TV distribution, as well as being the dominant choice for video delivery to PC and handheld devices, operators worldwide are now in the midst of establishing and implementing MPEG-2 to MPEG-4/H.264 transition strategies. In the large screen distribution model, what started as a telco IPTV-only trend has now grown well beyond that to all other market segments with the need for a variety of transcoding and re-coding modes: MPEG-2 to MPEG-4/H.264, MPEG-4/H.264 to MPEG-4/H.264, MPEG-4/H.264 to MPEG-2 and even MPEG-2 to MPEG-2.

The VMG supports these network evolution needs utilizing its flexible transcode and re-code mode support, via RGB's Transcoding Module (TCM). It performs any operation between MPEG-4/H.264 and MPEG-2, at various screen resolutions, ranging from high definition 1920 x 1080 all the way down to

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picture-in-picture (PIP) and handheld device resolutions. Furthermore, VMG content repurposing is best-in-class for its high capacity, allowing for the repurposing of up to 144 high definition-level and over 400 multi-resolution output operations in a single chassis. This capability allows complete channel lineup transcoding/re-coding, as well as multiple profile output support where one input is coded into different resolutions, bitrates or compression parameters to handle downstream network and consumer device needs. Superior video quality control is also a key benefit with bitrate control, programmable Group of Pictures (GOP) structure (including hierarchical GOP for MPEG-4/H.264), advanced noise filtering techniques, and picture resolution control.

AD INSERTION

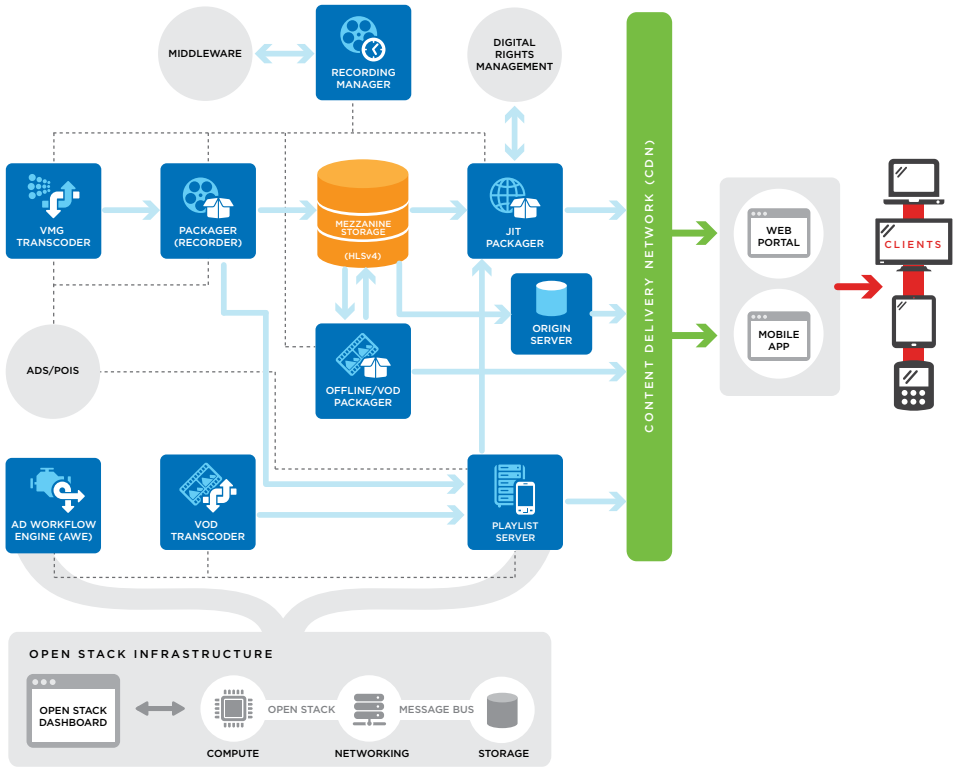
The flexibility of the VMG Gen1 allows it to be used for the implementation of a variety of applications critical to the success of today's video service providers. In the core of the network (or super headend), centralized functions are performed in the areas of transcoding, grooming and ESAM support for national/regional ad insertion and program substitution. Edge-level deployment allows for local content transcoding, grooming and ESAM support for local/zoned ad insertion and program substitution.

DIGITAL PROGRAM SUBSTITUTION

Leveraging the VMG's seamless splicing capability for multiple screen resolutions (HD, SD, PIP) and various compression codec support (MPEG-2, MPEG-4/H.264, Dolby Digital, AAC, MPEG-1 Layer II), digital program substitution allows a specific output to be seamlessly switched (spliced) between two different input programs under the control of a standards-based scheduling server.

This long-form seamless video switching technique allows network/local feed time-sharing for a given output, local blackouts due to content rights rules, or local/international time-sharing on an output to comply with regulatory requirements.

RGB's VMG Enables a Number of Critical Applications



OPERATIONAL SIMPLICITY WITH THE VMG

Operators can now benefit from advances in IP-based video headends and distribution, and the high-capacity, modular VMG platform fully leverages these next-generation network designs, with the added benefit of aggregated Gigabit and 10-Gigabit Ethernet links.

Legacy headends typically deployed transcoding and re-coding in a full decode, re-encode model that consisted of a chain of devices performing discrete functions. Furthermore, redundancy was handled at a network level with complex network management systems controlling third-party devices like baseband serial digital interface (SDI) and DVB-ASI routers to properly handle signal routing during a switchover. Service expansion also meant discrete devices required the availability of additional rack space, re-wiring of the network, and then a service-affecting upgrade to the network management system to incorporate the new additions.

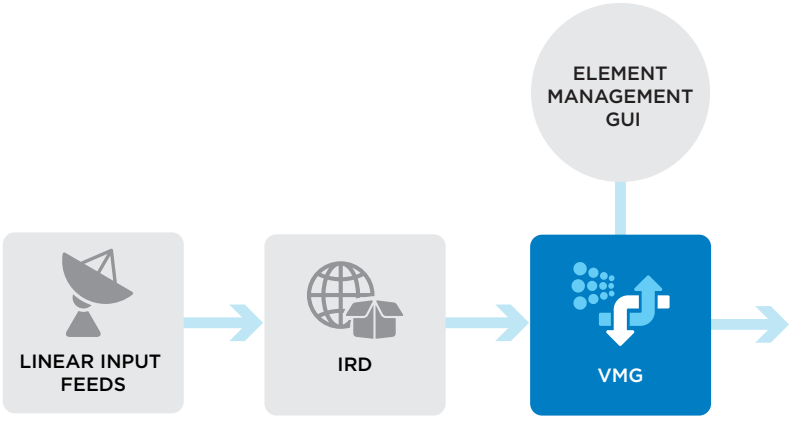
VMG-powered next-generation networks drastically reduce complexity and make service upgrades a much smoother experience. ASI links are terminated upstream in the chain and converted into Gigabit Ethernet, using a device such as RGB's Modular Media converter (MMC). At that point, Ethernet links connect through switches and routers for external routing and interface with the VMG chassis, with the switches performing aggregation of streams. The VMG then receives, processes, and outputs efficient IP links, utilizing its own redundant backplane for distribution of streams between modules inside the chassis. This internal switched backplane also performs automatic redundancy at a module level without the need for any external devices or complex network management systems. The VMG is instead controlled and monitored via a web browser-based Element Manager. Service expansion is handled in a modular fashion with empty chassis slots increasing hardware capacity, without any need to free up rack space or perform complex cabling.

VMG: THE CARRIER-CLASS VIDEO PLATFORM

In order to ensure uninterrupted service delivery, the VMG delivers very high levels of reliability. It has been designed from the outset to meet the highest levels of redundancy via a multi-level redundancy architecture. Exceptional reliability and fault-tolerance are enabled by the VMG's carrier-class chassis design, which incorporates extensive fail-over capabilities, comprehensive hardware and software component redundancy, as well as program and service level redundancy in case of program service failure, to ensure the highest levels of availability.

The 13-rack unit VMG-14 has 14 module slots, two of which are dedicated to the Network Processing Module (NPM) and the remainder available for any combination of application modules, today consisting of the Video Processing Module (VPM), Transcoding Module (TCM) and Application Media Processor (AMP). The NPM performs chassis control functions, external Gigabit Ethernet and 10-Gigabit Ethernet interfacing via SFP/XFP, as well internal backplane switching and routing of streams. The NPM, through its virtual IP and MAC address features, can be configured as 1:1 redundant. Its internal backplane switching allows automatic N:M application module redundancy where input and output streams to a given operational module are reconfigured to a standby module in the chassis with video services back up in a matter of seconds. The same architecture and identical NPM, VPM, TCM and AMP modules are available on the 7-rack unit VMG-8 chassis, which has eight slots, two of which are dedicated to the NPM controller.

Simple Network Configuration with the VMG



INTUITIVE, FLEXIBLE OPERATIONS WITH VMG

The VMG is monitored and configured through a web-based graphical user interface that is Java-based, allowing a variety of local or remote control consoles. The VMG's SNMP support also allows monitoring and/or configuration through third-party network management systems which may have a plant-wide scope of operations. The easy-to-use interface offers a variety of features that simplify the set-up and operation of the VMG, including program and transport level drag and drop grooming; simultaneous bitrate analysis of input and output transport streams grouped by input/output physical interfaces; alarms and system logs; and extensive diagnostics and troubleshooting capabilities.

The VMG interface supports multiple tiers of user access and password protection to prevent any unintentional operational issues, and additionally supports Remote Authentication Dial In User Service (RADIUS) and Terminal Access Controller Access Control System Plus (TACACS+) for more granular user authentication and authorization.

The VMG on-board database allows backup and restore operations for quickly configuring high-capacity networks while avoiding entry errors and time-consuming manual data entry.

RGB Networks, Inc.
390 West Java Drive, Sunnyvale, CA 94089
USA
T: +1.408.701.2700 | F: +1.408.701.2710
www.rgbnetworks.com

RGB VMG Specifications : VMG Gen1

MODULES	
Network Processing Module (NPM)	Runs host software and includes control, GigE, 10-GigE input/output interfaces
Transcoding Module (TCM) MPEG-2 and H.264 codecs	Performs real-time transcoding and re-coding functions for HD, SD and adaptive streaming-capable resolutions
Video Processing Module (VPM)	
Application Media Processor (AMP)	A general-purpose compute platform with applications including real-time audio transcoding
INPUT / OUTPUT INTERFACES (NPM)	
Gigabit Ethernet	1-Gigabit Ethernet, 8 x SFP ports (copper or fiber), IEEE-802.3z compliant 10-Gigabit Ethernet, 2 XFP ports (fiber), IEEE-802.3ae compliant (future support)
Fast Ethernet	1 10/100 BaseT control and management interface, RJ-45 connector
INPUTS	
Compression Formats	MPEG-2 up to Main Profile at High Level; H.264 up to High Profile at Level 4.1
Transport Level	Multi Program Transport Stream (MPTS); Single Program Transport Stream (SPTS); Up to 8,192 Elementary Streams
Resolutions, Scan	480i60 (30 or 29.97 fps) (Vertical: 480; Horizontal: 720, 704, 544, 528, 352); 720p60 (60 or 59.94 fps); 1080i60 (30 or 29.97 fps); 576i25 (Vertical: 576; Horizontal: 720); 720p50; 1080i50 (25 fps)
OUTPUTS	
Compression Formats	MPEG-2 Main Profile at Main Level (SD); MPEG-2 Main Profile at High Level (HD); H.264 High Profile up to Level 4.1; H.264 Main Profile up to Level 4.1; H.264 Baseline Profile up to Level 4.1 (PIP, MBR-TS output modes)
Transport Level	Multi Program Transport Stream (MPTS) (VPM); Single Program Transport Stream (SPTS) (VPM, TCM/AMP)
Video Bitrates (TCM)	MPEG-2 HD: 8-15 Mbps; MPEG-2 SD: 1-7 Mbps; H.264 HD: 2-15 Mbps; H.264 SD: 0.2-7 Mbps; H.264 PIP: 0.1-1 Mbps; H.264 MBR-TS: 0.1-8 Mbps
Resolutions, Scan	VPM: Same as input TCM: SD: User-configurable horizontal resolution on output, follow-input vertical resolution, scans SD on output with HD (both 1080i and 720p) on input, SD output with user-configurable horizontal resolution HD: User-configurable horizontal resolution on output, follow-input vertical resolution, scans Multi-bitrate mode Full HD resolution: 1920x1080, 1280x720p60/50 High resolution: 1280x720, 960x720, 960x540 Medium resolution: 720x576, 864x486, 848x480, 720x480, 640x480 Low resolution: 640x360, 624x352, 480x368, 480x320, 480x272, 448x336, 416x240, 400x360, 400x224, 352x288, 352x240,320x240, 320x180, 320x176, 192x192, 128x96, 96x96 Picture-in-picture (PIP): 352x288 (25 / 50 fps input), 352x240 (29.97 / 59.94 fps input), 192x192, 128x96; 96x96
VIDEO PROCESSING	
Processing Density (TCM)	Up to 36 SD programs per TCM when transcoding SD-SD or SD-PIP; Up to 12 SD or HD input programs per TCM and 24 outputs in full-screen transcode + PIP mode; Up to 12 SD or HD programs per TCM when trans coding HD-HD, HD-SD or HD-PIP; Up to 12 SD or HD input programs per TCM and 48 outputs in MBR-TS mode; Up to 12 TCMs per VMG-14 chassis1; Up to 6 TCMs per VMG-8 chassis
Transcode Modes (TCM)	MPEG-2 to H.264; H.264 to MPEG-2; H.264 to H.264; MPEG-2 to MPEG-2 PIP and MBR-TS outputs are transcoded to H.264 outputs regardless of input
H.264 Video Processing (TCM)	Programmable GOP structure; adaptive GOP based on scenes2; all intra prediction modes; ¼ pixel interpolation; multiple reference frames; P and B pictures; block sizes: 16 x 16, 8 x 8, 16 x 8, 8 x 16; coding: CABAC entropy coding
Rate Control (TCM)	CBR or VBR input; CBR output
Noise Reduction (TCM)	Motion Compensated Temporal Filter (MCTF) noise reduction
Film Processing (TCM)	Telecine (MPEG-2)
SYSTEM CAPACITY	
Max Unique IP Multicast Inputs	600 per host
Max Unique IP Multicast Output	508 per host
Program Substitution Capacity	396 SD or 132 HD concurrent / VMG system (chassis); applies to H.264 or MPEG-2 or a mix
SYSTEM SPECIFICATIONS	
IP Networking	IP/UDP; RTP; IGMPv3
Device Latency	<1.5 sec (no transcoding); <4 sec (with transcoding)
Multiplexing & Table Processing	MPEG-2 and MPEG-4/H.264 multiplexing and re-multiplexing; MPTS, SPTS, multicast and unicast support; CBR and VBR support; PAT and PMT generation; PID filtering and re-mapping; Generation and pass-through of ATSC PSIP tables (incl. A/65); DVB-SI table regeneration
Network Jitter Tolerance	+/- 100 msec

RGB VMG Specifications : VMG Gen1 (continued)

AUDIO PROCESSING	
Audio Formats	Dolby Digital (AC-3); AAC-LC; MPEG-1 Layer II; MPEG-2 Audio; HE-AAC v1/2, Dolby Digital Plus (EAC3)
Output Audio Codecs	Pass-through (in modes other than PIP or multi-bitrate); AC-3; HE-AACv1/2, and MPEG-1/2 Layer II output in transcode modes, Dolby Digital (AC-3), Dolby Digital Plus (E-AC-3)
Transcoded Audio Output Data Rate	6 - 512 kbps, specified values depending on output codec selected
Transcoded Audio Sampling Rate	8kHz, 11.1, 12, 16, 22.1, 24, 32, 44.1, 48 kHz depending on output codec selected
Transcoded Audio Gain Control	-24 dB to +24 dB, increments of 1 dB
Transcoded Audio Channels	5.1 / 2 / 1 input; 5.1 / 2 / 1 output
ANCILLARY DATA PROCESSING	**SUPPORT FOR**
	Closed captioning: SCTE-20 (CEA-608) for MPEG-2, SCTE 21 (including EIA-608, EIA-708) for MPEG-2, SCTE 128 for H.264: SCTE 35 pass-through, ESAM support and SCTE 35 Cue insertion; EBP in Adaptation Field, NAL-HRD Setting, ISO 639 Language Descriptor Add/Modify
CONTROL/MANAGEMENT	
Module Redundancy	All modules hot swappable; 1:1 NPM, AMP module redundancy; N+M TCM, VPM module redundancy
Program/Service Redundancy	Yes - common to VMG platform; backup program pre-defined and used in case of loss of primary input4
Management	Embedded web-based UI using XML/RPC protocols; Java-based application; SNMPv1 / v2c; multi-user access control; AAA (Radius, TACACS+)
REGULATORY COMPLIANCE	
Safety	CB 60950-1 With National differences CA, DE, FI, IL, KR,US
	Test Spec IECxxx. ENxxx) IEC 60950-1:2005 (2nd Edition); Am 1:2009
	EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011
Electro Magnetic	Subpart B of Part 15 of FCC Rules for Class A digital devices
	EN 55022:2010, CISPR 22:2008, AS/NZS CISPR 22:2009: EN 55024:2010, CISPR 24:2010, EN 61000-3-2:2006 +A1:2009 +A2:2009, EN 61000-3-3:2008
	ICES-003, "Information Technology Equipment (ITE) – Limits and methods of measurement", Issue 5, dated August 2012 (Class A)
ELECTRICAL/MECHANICAL	**VMG-14+-DC:** / **VMG-14+-AC:**
Input Power	-48 VDC nominal (-41 to -60 VDC range) 70 Amps per power feed (total 4 feeds) / 220 VAC nominal (180 to 264 VAC range) 11 Amps per power feed (total 4 feeds)
Overcurrent Protection	70 Amp circuit breaker on PEM / 15 Amp fuses on PEM
Power Consumption	6000 Watts maximum – fully loaded / 6000 Watts maximum – fully loaded
Dimensions	13 rack units 22.75" H X 19.00" W X 21.00" D (578.0 H x 482.6 W x 533.4 D mm) / 14 rack units 24.50" H X 19.00" W X 21.00" D (622.3 H x 482.6 W x 533.4 D mm)
Weight (assembled)	VMG-14+-DC: 103.7 lbs. (47.1 kg) / VMG-14+-AC: 111.6 lbs. (50.7 kg)
Cooling (air flow direction)	Front (bottom) to rear (top) / Front (bottom) to rear (top)
OPERATIONAL ENVIRONMENT	
Storage Temperature	-40° to 70° C (-40° to 158° F)
Operating Temperature	0° to 45° C (32° to 113° F)
Ambient Temperature (transient operation)	+5° to 55° C (41° to 131° F)
Humidity	5% to 85%, non-condensing; Transient operation: +5% to +90%, non-condensing

1. Multi-bitrate mode benchmarked with 9+1 TCM and 1+1 AMP configuration (54 inputs, 432 outputs with a 1:8 output profile ratio); consult RGB for configuration-specific maximum tested TCMs per VMG-14 chassis.
2. Full resolution transcode mode.
3. Contact RGB Networks for specific conditions for this specification.
4. As defined by input PAT/PMT tables or video elementary stream, differs by module.
5. Watts maximum for fully loaded VMG chassis with currently available VMG modules, consult RGB for futureVMG module power requirements

RGB Networks, Inc.
390 West Java Drive, Sunnyvale, CA 94089
USA
T: +1.408.701.2700 | F: +1.408.701.2710
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