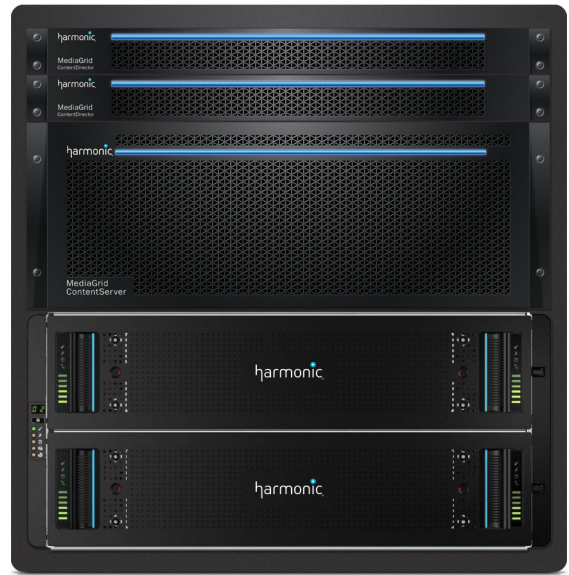


Harmonic MediaGrid

SHARED STORAGE



Harmonic MediaGrid is a highly scalable, Ethernet-based shared storage system optimized for digital media workflows.

Proven in the world's most-demanding video environments, MediaGrid is an ideal fit for digital media applications requiring shared, real-time storage, such as ingest, playout, archive, edit-in-place, collaborative editing, transcoding and over-the-top (OTT) adaptive bitrate streaming. Simple to deploy, manage and scale, MediaGrid storage accelerates file-based workflows and provides the ability to manage the entire asset lifecycle. The system reduces the cost of storing media nearline, making it practical to economically deploy multi-petabyte digital media libraries and archives for video on demand (VOD) and other applications.

MediaGrid is purpose-built from the ground up to deliver high bandwidth and consistent low latency for video. Its exceptional performance is enabled by a proprietary distributed file system and the installation of the MediaGrid file system driver (FSD) on each client server. Unlike competing clustered NAS systems, which can only access data through one path at a time, the Harmonic FSD enables MediaGrid to deliver maximum performance through true parallel access across many storage nodes and network connections.

MediaGrid systems can be built in a variety of configurations to meet the exacting requirements of diverse use cases. Media operations can start with smaller MediaGrid systems —as little as 48 TB of usable capacity — and seamlessly scale to petabytes of capacity and tens of gigabytes per second of throughput. An industry-leading, high-density storage option — up to 504 TB of raw capacity in 5 RU — can reduce rack space by up to 60% and lower storage-related costs by up to 30%, minimizing total cost of ownership (TCO) through its exceptional price/performance capabilities.

Use Cases		
Ingest	Color grading	Nearline storage
Editing	Transcoding	Origin stream serving
Archive	Media asset management	Playout staging

HIGHLIGHTS

- Ethernet-based, scale-out shared storage
- Superior, consistent performance for media workflows
- High-density, up to 504 TB of raw capacity in 5 RU
- Unique file system technology enables exceptionally high bandwidth across all capacity points
- Simple and cost-effective to deploy, manage and scale
- Integrates with Spectrum™ media servers and Harmonic ProMedia® X Origin streaming video server
- Qualified and optimized with dozens of leading media applications

High Scalability

MediaGrid is based on a fully distributed scale-out architecture, resulting in increased performance as additional storage nodes are added. Nearly 2 GBps of bandwidth can be delivered to a single client, with aggregate bandwidth reaching tens of gigabytes per second. As the system is expanded, bandwidth and capacity increase linearly, actually improving access speed to content already on the system. The high performance of MediaGrid even enables the transfer of uncompressed files over Ethernet.

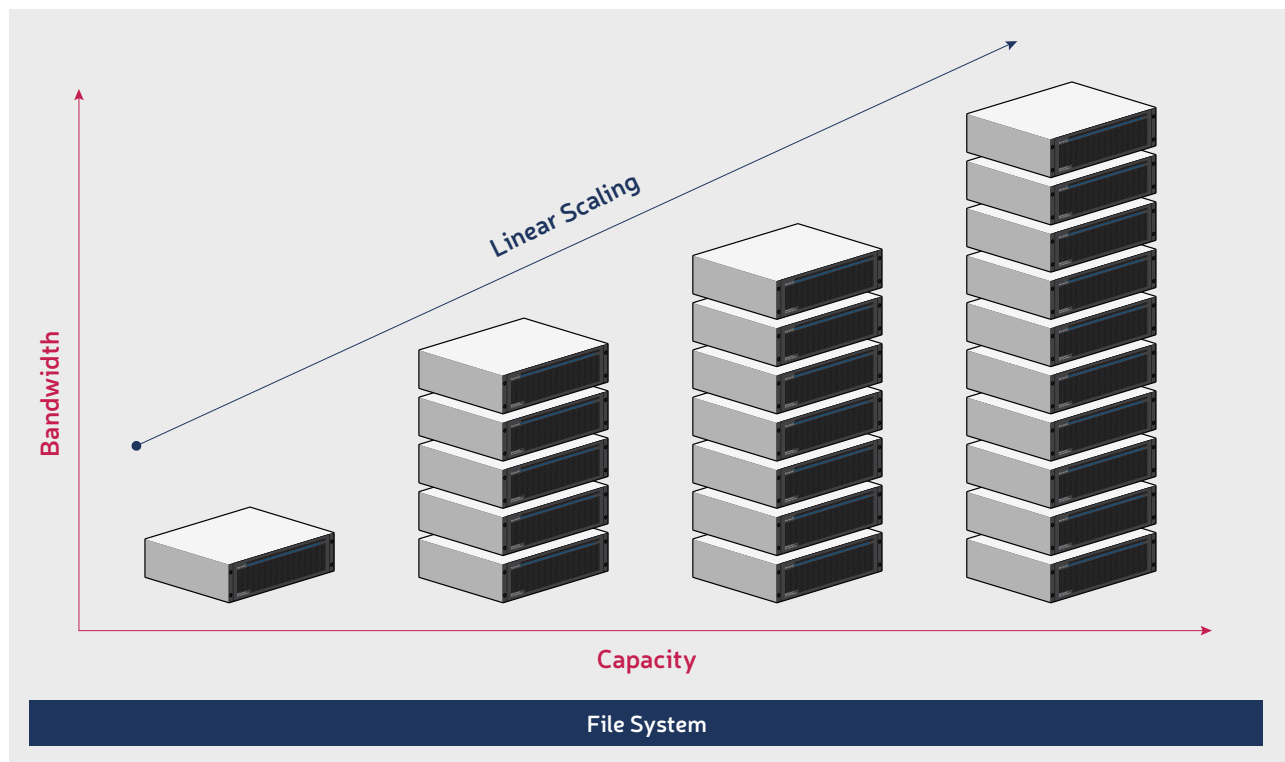
Bandwidth consistency also sets MediaGrid apart. On competing storage systems, performance may significantly degrade over time due to data fragmentation. The MediaGrid file system stripes data across all system servers, and clients then access the servers in parallel, ensuring reliable performance for any application, at any time.

Simple and Cost-Effective

MediaGrid is remarkably simple to deploy. Based on standard hardware components and cost-effective Ethernet technology, the system is also economical to purchase and maintain. Many alternative media storage systems utilize Fibre Channel SANs to deliver the required levels of performance, but Fibre Channel is far more complex than Ethernet and requires expensive, specialized personnel to manage it. In many cases, these competing systems require a forklift upgrade to expand beyond the performance or capacity limits on a single controller, leading to higher costs upon initial deployment and when adding capacity. Not so with MediaGrid.

Media workflows often demand the ability to quickly and continuously add new content, necessitating a need to easily scale. On some systems scaling can be management-intensive and highly disruptive to users and applications alike. With MediaGrid, scaling is fast and unobtrusive: storage nodes are added, the additional capacity is absorbed by the file system, and existing data is transparently rebalanced across the new nodes as a background task. There's no need for file system reconfiguration as you scale, or for file system defragmentation as the file system ages.

With a single global name space that can scale to multiple petabytes, MediaGrid also eliminates the need to create and manage multiple volumes.



MediaGrid enables simple online scaling of both bandwidth and capacity

Optimized for Media Workflows

MediaGrid was designed from the ground up for the demanding requirements of digital media workflows, and is tested and optimized with dozens of leading media systems, including Harmonic Spectrum media servers and ProMedia™ X Origin multiscreen media servers. It also enables collaborative editing workflows with nonlinear editors, such as Apple® Final Cut Pro®, Avid® Media Composer®, and Adobe® Premiere® Pro.

The advanced media-specific functionality delivered by MediaGrid reflects Harmonic's deep expertise with media applications and workflows. For example, MediaGrid enables editing of growing files, a critical capability in environments such as news broadcasting, and variable block sizes to optimize performance for different types of media workloads. The MediaGrid FSD intelligently uses client-side memory to read ahead and store portions of media files before they are requested by the application, providing extremely fast access to media.

Reliability and Availability

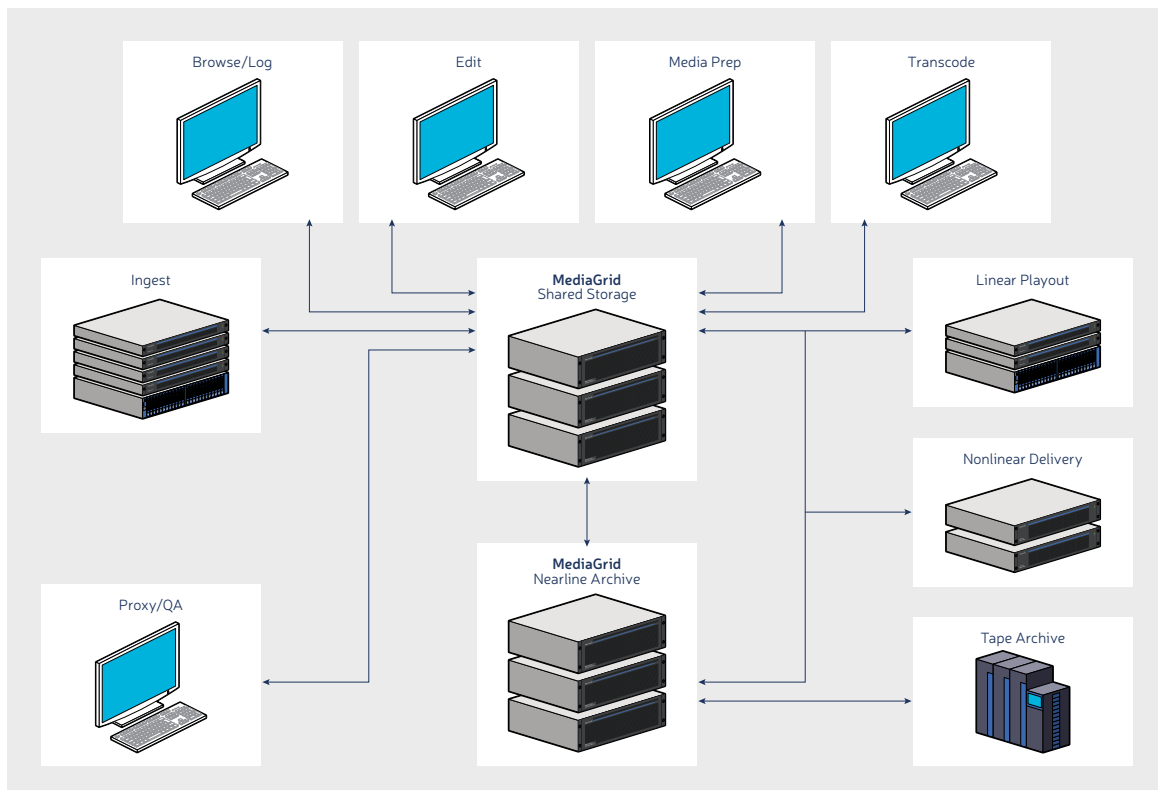
Shared storage is a critical resource in file-based workflows, and MediaGrid is built for the task. MediaGrid systems have no single point of failure, and leverage features such as dual active-active controllers with transparent failover, redundant data paths to protect against storage node failures, and transparent client failover to protect against controller failures. Software RAID options include RAID 4 and RAID 6, offering protection against unlikely events such as multiple drive failures within a RAID group.

In addition to the powerful fault resiliency capabilities of MediaGrid, the system is built to eliminate downtime associated with planned maintenance activities. Storage nodes can be added to the system while it is running, and no down time is required for activities such as software and firmware upgrades.

To protect business-critical assets, MediaGrid offers an advanced campus-level disaster recovery configuration. Data in a MediaGrid system can be transparently replicated across different physical locations on a campus while remaining under a single file system. In the event of a site outage, clients will transparently and automatically route to alternative storage, providing extreme levels of data and workflow protection.

World-Class Service and Support

Harmonic stands behind MediaGrid shared storage systems with comprehensive service and support programs, including system design, service deployment, technical support and network maintenance. World-class service plans and a global network of flexible and responsive support professionals help ensure your ability to deliver outstanding "anytime, anywhere, any-device" customer experiences.



MediaGrid shared storage for file-based media workflows

MediaGrid shared storage is available in a variety of configurations to meet the exacting requirements of diverse use cases. All MediaGrid systems begin with ContentDirector and ContentServer systems. Storage capacity is expanded by adding ContentStore chassis. ContentBridge systems are used to connect to NAS networks.

BASE SYSTEM COMPONENTS

ContentDirectors

ContentDirectors store, manage and serve file system metadata, and present a single global namespace. Each MediaGrid system includes two ContentDirectors in an active-active failover configuration. Solid-state metadata storage provides high performance and resiliency.



ContentServer 4000

ContentServer 4000 nodes provide processing power and storage capacity for MediaGrid with 24 hot-swappable enterprise SAS drives and a choice of 48 TB, 96 TB or 144 TB of raw storage per 4-RU chassis. Connectivity is via eight 10-GbE ports. Dual active-active controllers are included in each unit.



ContentServer 3000

ContentServer 3000 systems provide both processing power and storage capacity: 16 hot-swappable enterprise drives and a choice of 32 TB, 64 TB or 96 TB of raw storage capacity within a single 3-RU chassis. Connectivity is via four 10-GbE ports. Dual active-active controllers are included in each unit.



STORAGE EXPANSION

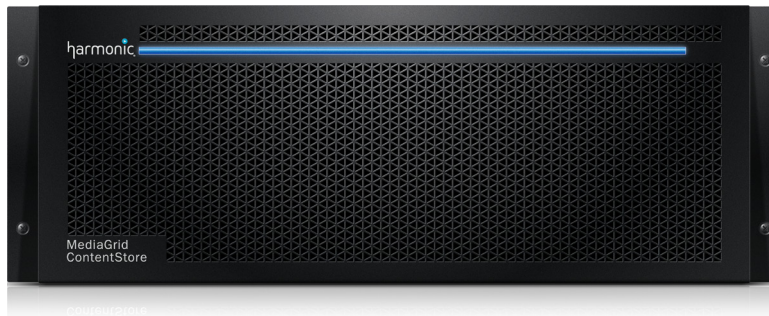
ContentStore 5840

ContentStores are individual storage-only nodes featuring dual active-active SAS expanders and a choice of RAID 4 or RAID 6 protection. Up to five ContentStores can be connected to each ContentServer to provide cost-efficient scaling. The high-density, 5-RU ContentStore 5840 system includes 84 2-TB, 4-TB or 6-TB drives, for up to 504 TB of raw storage capacity. Convenient drawer-based, hot-swap access to the drives simplifies storage expansion and maintenance.



ContentStore 4240

The 4-RU ContentStore 4240 provides raw storage capacity of 48, 96 or 144 TB via 24 hot-swappable 2-TB, 4-TB or 6-TB enterprise drives



ContentStore 3160

The 3-RU ContentStore 3160 system offers a choice of 16 hot-swappable 2-, 4- or 6-TB enterprise drives, for a total of 32, 64 or 96 TB of raw capacity.



NAS ACCESS

ContentBridge

Optional ContentBridge 2000 modules can be added to MediaGrid to provide access to NAS protocols, including CIFS, NFS or FTP, via two 10-GbE ports.



MediaGrid BasePacks

To provide convenient configurations from which to build a MediaGrid system, several BasePacks are available. MediaGrid BasePacks are complete entry-level system configurations, and include two ContentDirectors, one ContentServer with 16 drives, and all system software.

BasePack Model	(Raw)	10-GbE Ports	ContentDirectors	SystemManager, ContentManager
MG-BASE4000-2TB-8X0	48 TB	8	2	✓
MG-BASE4000-4TB-8X0	96 TB	8	2	✓
MG-BASE4000-6TB-8X0	144 TB	8	2	✓

MediaGrid Component Specifications

	ContentServer 4000	ContentServer 3000	ContentStore 5840	ContentStore 4240	ContentStore 3160	ContentBridge 2000
Function	Processor and storage node	Processor and storage node	Storage node	Storage node	Storage node	NAS gateway for FTP, CIFS, NFS
Disk Drives	24 hot-swap 3.5" SAS drives: 2 TB, 4 TB or 6 TB enterprise	16 hot-swap 3.5" drives: 2 TB, 4 TB, 6 TB enterprise	84 drawer-based hot-swap drives: 2 TB, 4 TB or 6 TB	24 hot-swap 3.5" SAS drives: 2 TB, 4 TB or 6 TB enterprise	16 hot-swap 3.5" drives: 2 TB, 4 TB, 6 TB enterprise	Two 240-GB SSDs
Raw Capacity (per chassis)	48 TB, 96 TB or 144 TB	32 TB, 64 TB or 96 TB	336 TB or 504 TB	48 TB, 96 TB or 144 TB	32 TB, 64 TB or 96 TB each	
Network Connectivity	Eight 10-GbE ports	Four 10-GbE ports				Two 10-GbE ports
Form Factor	4 RU	3 RU	5 RU	4 RU	3 RU	1 RU
Controller Configuration	Two controllers per unit, active-active	Two controllers per unit, active-active	Two 6-Gb SAS expanders per unit, active-active	Two 12-Gb SAS expanders per unit, active-active	Two 6-Gb SAS expanders per unit, active-active	
NVRAM	1 GB per controller	1 GB per controller				
Storage Connectivity			Dual redundant 6-Gb SAS fabric	Dual redundant 12-Gb SAS fabric	Dual redundant 6-Gb SAS fabric	

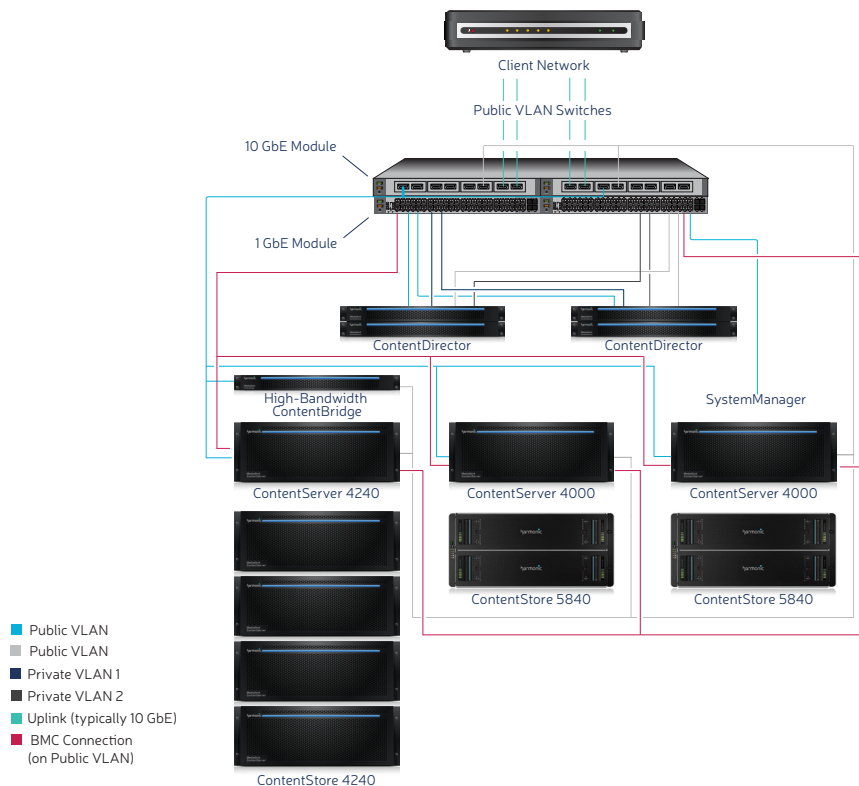
Component Environmental Specifications

By using the environmental specifications for each individual component provided below, aggregate system-level environmental specifications can be generated for any MediaGrid configuration.

	ContentServer 4000	ContentServer 3000	ContentStore 5840	ContentStore 4240	ContentStore 3160	ContentBridge 2000
Width	19 in/48.3 cm	17.2 in/43.7 cm	17.2 in/43.7 cm	19 in/48.3 cm	17.2 in/43.7 cm	17.1 in/43.4 cm
Height	7 in/17.8 cm	5.2 in/13.2 cm	8.6 in/21.9 cm	6.9 in/17.4 cm	5.2 in/13.2 cm	1.7 in/4.3 cm
Depth	27.5 in/69.9 cm	25.5 in/64.8 cm	38.0 in/96.5 cm	21 in/53.4 cm	25.5 in/64.8 cm	24.7 in/62.7 cm
Weight (max)	104 lbs/47 kg	90 lbs/41 kg	288.9 lbs/131 kg	63.9 lbs/29 kg	78 lbs/35 kg	35 lbs/15.9 kg
Input Power	100-240 V, 50-60 Hz	100-240 V, 50-60 Hz	200-240 V, 50-60 Hz	100-240 V, 50-60 Hz	100-240 V, 50-60 Hz	100-240 V, 50-60 Hz
Cooling	3047 BTU/hr @ 893 W	2912 BTU/hr @ 854 W	6261 BTU/hr @ 1835 W	1436 BTU/hr @ 421 W	718 BTU/hr @ 210 W	797 BTU/hr @ 234 W

System-Level Specifications

Capacity (usable)	48 TB to multiple petabytes in a single file system
Performance	Bandwidth up to tens of GBps per system
Scaling	Linear, non-disruptive scaling by adding nodes
RAID support	RAID 4 or RAID 6
Operating System Support (with File System Driver)	Windows MacOS Linux
NAS Protocol Support	FTP, CIFS and NFS via optional ContentBridge
Network Interfaces	10-Gb server interface with support for 10-, 40- and 100-Gb clients
High Availability	No single point of failure Redundant hot-swap controllers Hot-swap disk drives Hot-swap power supplies Redundant SAS fabric Online software upgrades Online firmware upgrades Replication for disaster recovery
Included Software	File System Driver (unlimited license) for client access to data ContentManager for managing quotas and access MediaGrid System Manager Replication
Operating Temperature	32° to 95° F/0° to 35° C Max change 50° F/10° C per hour
Operating Humidity	20% to 80% non-condensing Max change 10% per hour
Compliance	RoHS compliant
Safety and EMC	USA: UL and FCC Canada: cUL Europe: CE Derivative certifications available for other countries



Harmonic MediaGrid 4000 system with ContentStore 4240 and 5840 storage expansion nodes