



AVID NEXIS

Media Mirror Protection for Enterprise Engines

The answer for today's fast-turnaround workflows

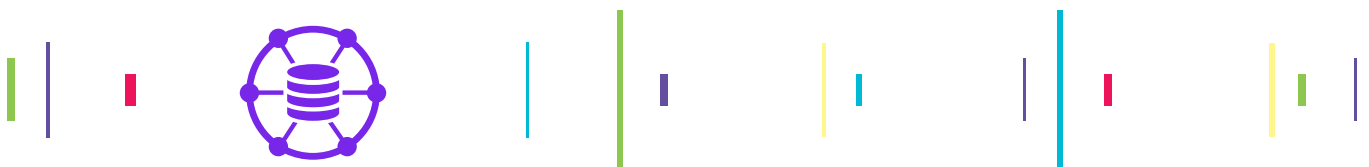


WHY IS MEDIA MIRROR PROTECTION REQUIRED FOR TODAY'S WORKFLOWS?

Avid NEXIS® is the leading shared storage choice of media professionals, enabling collaborative workflows across every type of production environment—from growing post-production teams to the largest broadcasters. One increasingly common factor across these diverse workflows is that today's incredibly tight deadlines are driving the need for shared storage solutions that can deliver non-stop editing workflows—even when the storage encounters a variety of failure modes.

All workflows across the industry are under the same pressures, driven by tighter deadlines to deliver more projects faster. Everyone understands the critical nature of broadcast workflows; however, what most people have been slow to acknowledge is that post-production workflows have just as strict deadlines—especially when producing fast-turnaround highlights packages for live events and reality TV. In addition, the workflow impact of an outage—whether lasting a few minutes or multiple hours—should be considered when configuring any shared storage system. Avid NEXIS Mirror Protection allows the workflow to continue without interruption to users.

In this paper, we explore the media and workflow protection schemes available in Avid NEXIS and how these features deliver a cost-effective, scalable, highly available solution.



UNDERSTANDING AVID NEXIS

The Avid NEXIS F-series line of engines is the culmination of over 25 years of Avid designing and delivering innovative shared storage solutions for media professionals. With legacy Avid Unity storage and Media Composer® editing software, Avid invented the collaborative shared storage workflows in use by thousands of organizations today, ranging from small editing teams to the largest post and broadcast facilities.



Avid NEXIS F-series storage family

Avid NEXIS is built from several modular building block concepts. Each set of 10 media drives is called a Media Pack; each Avid NEXIS storage engine type can house one or more Media Packs. The Avid NEXIS | F2 engine and F2X expansion storage unit house one Media Pack each and the F5 can support up to eight Media Packs.

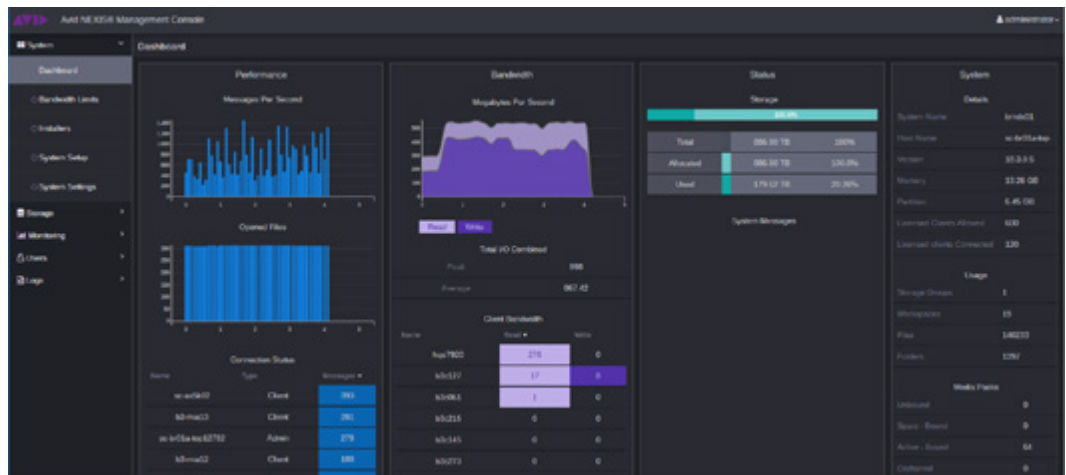
Each Media Pack provides a defined amount of total storage (currently 60, 100 and 140 TB) and a constant 480 MBytes/second of bandwidth (per HDD Media Pack). An Avid NEXIS system is sized and scaled by provisioning sufficient Media Packs to accommodate the overall bandwidth and capacity needs of the users. One of the functions of the Media Pack is to provide a defined recovery domain—any simple disk failure is repaired and recovered within the Media Pack, avoiding an impact on the overall system.

A common request from customers is to deliver a storage solution that has higher fault tolerance, enabling editors, producers, and assistants to continue working even if the storage system encounters a failure. We hear from customers of

all types and sizes that deadlines are getting tighter and the pressure to turn around more projects faster is higher than ever. The design criteria for Avid NEXIS included media protection and redundancy configuration options that can be added when needed, plus flexible media protection that enables customers to choose the right protection level for each project, optimizing their Avid NEXIS storage in a way that is not possible with any other media storage solution.

Each Avid NEXIS engine is built from one or more Media Packs bound together as a storage group to provide a common pool of storage capacity and bandwidth. Each Avid NEXIS engine can have one or more storage groups; a single storage group provides the most flexible allocation of space and delivers the maximum bandwidth to all workspaces. Deploying multiple storage groups allows bandwidth to be divided between user storage workspaces and increases overall reliability by decreasing the failure group's size.

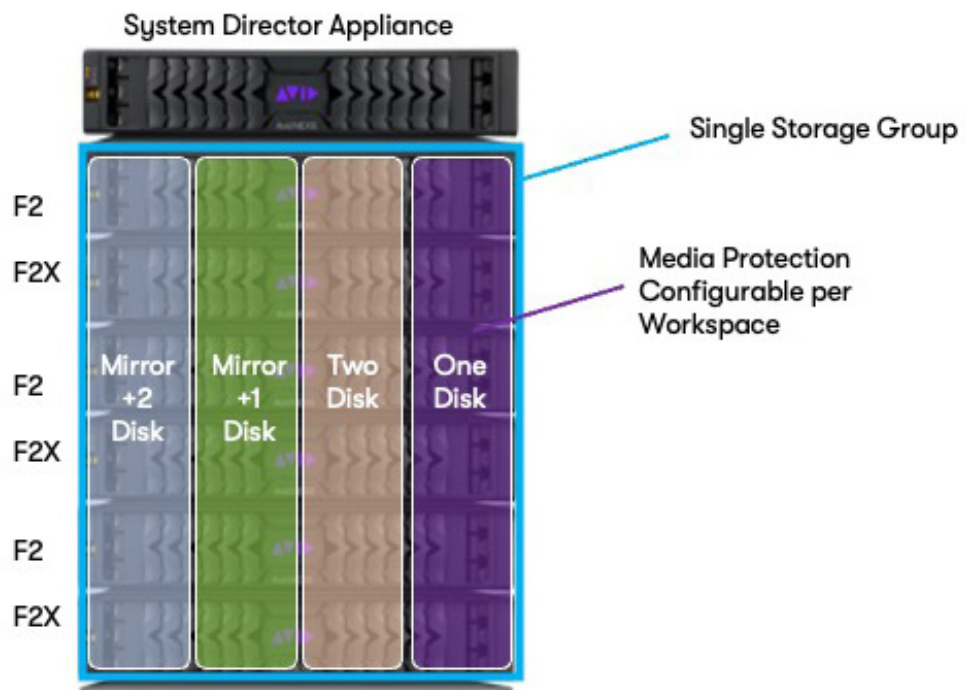
User workspaces are provisioned on a storage group; typical systems have many workspaces per storage group. These workspaces are individual mount points with specific user permissions and capacity. The capacity of a workspace is easily increased or decreased using the Avid NEXIS Management Console, while all users are active. Each workspace has full access to the total bandwidth provisioned in the storage group.



Avid NEXIS Management Console

AVID NEXIS MEDIA PROTECTION TYPES

Avid NEXIS Enterprise engines have four levels of media protection ranging from 1-Disk Protection to Mirror plus 2-Disk Protection. A suitably configured Avid NEXIS enables each workspace to be configured with any protection type. This flexibility allows mirror protection for those workspaces that require the highest level of protection. Mirroring delivers seamless operation, with no interruption to the workflow in the event of a wide variety of failure modes, including total loss of an entire storage engine.



Avid NEXIS Enterprise engines have some simple configuration guidelines to enable mirror protection. A mirror-capable system requires three or more Avid NEXIS | F2, F2+F2X or F5 storage engines configured with the same number and capacity of Media Packs, plus the Avid NEXIS | System Director Appliance. Avid NEXIS | F2 and F2+F2X, and F5 systems can be deployed as mirror-capable, or they can be expanded and upgraded to meet the mirror-capable requirement.

Avid NEXIS | F5 can be partially populated; however, all engines must have the same number of Media Packs. This allows a configuration of three half-populated F5 engines to support a media-mirrored configuration that can be expanded by adding Media Packs to all engines simultaneously. At least three engines are required to enable mirror protection, ensuring that new media is always written to two separate engines—even in the case of a failed engine. Avid NEXIS automatically detects if a storage group is mirror-capable and enables engine protection as an option when creating workspaces.

The chart below describes the various types of media protection available with Avid NEXIS Enterprise storage solutions.

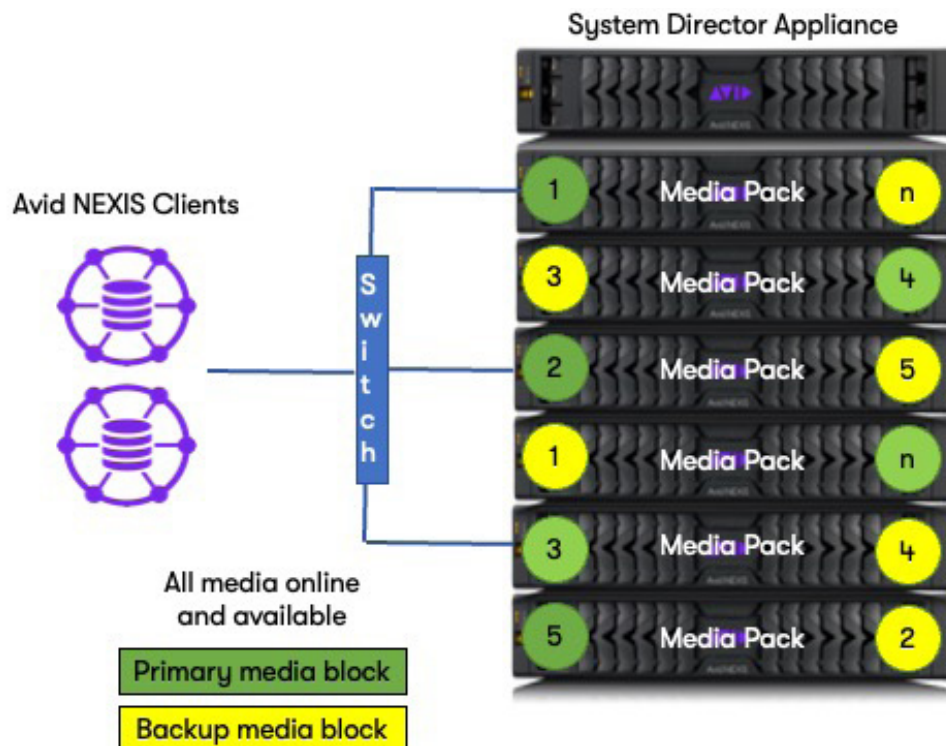
TABLE 1: Avid NEXIS Media Protection Types

PROTECTION TYPE	DETAILS	IDEAL FOR...
Unprotected	0 Parity—any drive failure takes media offline	Assets and files that are stored on at least two other systems, where time to restore is not critical. If one disk fails, media becomes unavailable. To restore material, assets would need to be copied back into Avid NEXIS, which may take many hours. Not recommended for active projects.
1-Disk Protection	1 Parity block per media stripe 1 drive failure tolerated per Media Pack	Assets and files that are stored on at least two other systems, where time to restore is not critical. Media would become unavailable if more than one disk failure in a Media Pack occurs; in this event, assets would need to be copied back into Avid NEXIS, which may take many hours to restore material.
2-Disk Protection	2 Parity blocks per media stripe 2 drive failures tolerated per Media Pack	Assets and files that are stored on at least one other system, where time to restore is important (i.e., users need to maintain quick access to these assets without interruption to their overall workflow). 2-Disk Protection is the default for most workspaces and is ideal for ingest, editing, providing a library of commonly used assets, and more.
Mirror plus 1-Disk Protection	Offers protection against: <ul style="list-style-type: none"> > Any engine failure, or > Any 3 drive failures, or > Any engine, plus 1 drive failure per Media Pack in the Avid NEXIS storage group 	Assets in constant use, where access to project files and media are required for tight deadline projects. Assets are stored on at least one other system.
Mirror plus 2-Disk Protection	Offers protection against: <ul style="list-style-type: none"> > Any engine failure, or > Any 5 drive failures, or > Any engine, plus 2 drive failures per Media Pack in the Avid NEXIS storage group 	Project files and media required for broadcast deliverables, tight deadline projects, finished projects required for client screenings, and high-scale workflows. Assets are stored on at least one other system.

Avid 1-Disk and 2-Disk Protection are superior to traditional RAID-5 and RAID-6 in that the Avid NEXIS | VFS file system is media-aware and only needs to rebuild disk sectors in use, unlike traditional RAID systems, which rebuild the total capacity of the disk including unused space. The Avid NEXIS approach is superior because it gets the system to a fully-protected state faster.

Avid Mirror Protection, also known as Seamless Engine Protection, is an additional protection level that creates a mirrored media block on a different engine within the same storage group. Mirror Protection is designed to provide non-stop editing in the event of the failure of a complete Media Pack, storage engine, or other event, like a network disconnect or full engine power loss that renders the engine unreachable.

AVID NEXIS MEDIA PACKS AND MEDIA BLOCKS



WHY MIRROR PLUS 1- OR 2-DISK PROTECTION

Avid NEXIS Mirror Protection is built on top of 1-Disk or 2-Disk Protection so that a disk failure is recovered locally within the 10-drive Media Pack without system-wide impact. Avid NEXIS does not support mirror protection with unprotected workspaces because while the mirror protection would prevent media loss, the whole system would be impacted by a simple single disk failure. Also, a mirror configuration with unprotected workspaces would be tolerant to only a single disk failure, whereas the Avid NEXIS solution provides protection against any five disk failures with Mirror plus 2-Disk Protection or any three disk failures with Mirror plus 1-Disk Protection.

These figures are the worst-case scenario where the disk failures are concentrated in a few Media Packs. It's possible for a single Avid NEXIS system to have more disk failures if they are spread across multiple Media Packs. Notifications about any disk failures are displayed in the Avid NEXIS Management Console, as well as by email alerts if configured. Avid recommends replacing failed drives at the earliest opportunity. Hot spare drives are optional for Avid NEXIS | F2 + F2X and included in Avid NEXIS | F5, enabling automated recovery and restoration to a fully-protected state without administrator intervention.

TABLE 2: Workspace Protection and Workflow Impact

CLIENT IMPACT DUE TO A FAILURE MODE	WORKSPACE PROTECTION	
	MIRROR + 1-DISK	MIRROR + 2-DISK
Storage engine controller switch-over (dual controllers)	No interruption	No interruption
Single network link loss (when using interface redundancy)	No interruption	No interruption
Engine network isolation (all links down)	No interruption	No interruption
Storage engine complete power loss	No interruption	No interruption
1 media drive failure per Media Pack	No interruption	No interruption
2 media drive failures per Media Pack	No interruption	No interruption
SDA Controller switchover	1–2-minute pause in workflow	1–2-minute pause in workflow

When each workspace is created, the administrator can select the media protection level appropriate for the perceived value of the media assets in that workspace. Avid NEXIS is very flexible, offering extensive configurability to provide a different level of protection for each workspace, which enables the protection level and total useable space to be optimized to meet the business need. A traditional system configured for mirroring gives up half its total storage for the mirror copies. Avid NEXIS is much more efficient as it allows for workspace-by-workspace protection, providing higher effective storage utilization (see the table on the next page) for typical systems that employ a combination of 2-Disk Protected workspaces for the main assets and Mirror plus 2-Disk Protection for the most critical assets and workflows.

TABLE 3: Storage Efficiency

PROTECTION TYPE	USER CAPACITY REQUIRED (TB)	TOTAL SPACE ON DISK (TB)	USABLE %
Unprotected	20	20	100%
1-Disk	25	28	89%
2-Disk	200	250	80%
Mirror plus 1-Disk	0	0	44%
Mirror plus 2-Disk	40	100	40%
	285	398	72%
	User Capacity	Total Capacity	Effective Usable %

WHY YOUR CONFIGURATION SHOULD BE MIRROR-CAPABLE

Avid NEXIS Mirror Protection delivers non-stop workflows for the most critical fast-turnaround and broadcast workflows. This is possible because of Avid NEXIS Due Times, an Avid-patented technology unique to the Avid NEXIS client that issues a “required by” time in all media requests from the client to Avid NEXIS storage. The Avid NEXIS Due Time mechanism provides feedback to the Avid NEXIS client to request media from the alternate mirror block if the original request is not acknowledged within the expected time. This protects against a wide range of issues, including:

- > A complete engine failure
- > Engine isolation from the network
- > A temporary pause due to an engine controller switchover
- > Multiple disk failures in a single Media Pack
- > Media traffic congestion

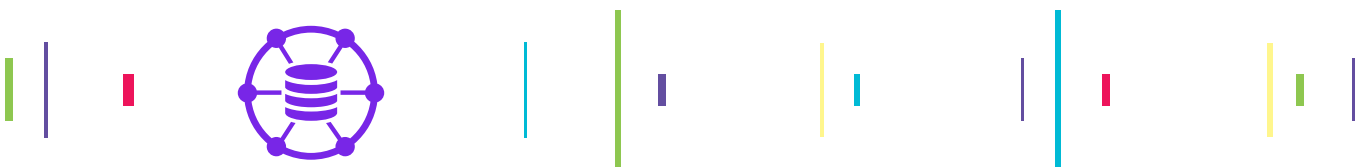
In this way, the Avid NEXIS client can request required media blocks from the alternate location before the media is required by the client application, so that the editor can be playing a timeline and see no interruption even if an engine fails.

CONCLUSION

Today's workflows are very time-sensitive. Whether working on high-value content, managing high volumes of reality TV media, or producing fast-turnaround packages for live events, broadcast sports, or news workflows, the impact of downtime—however brief—should be carefully considered.

Avid NEXIS Enterprise storage solutions can be configured to allow all of these workflows to continue without interruption. Without Avid NEXIS Media Mirror Protection, a number of system events can interrupt the workflow—from a few minutes for a storage engine controller switchover, to multiple hours to restore an engine or Media Pack failure. Administrators should carefully consider the workflow cost of such events and the trade-off of adding Mirror Protection for critical assets and workflows.

To fully take advantage of the power, flexibility, and protection Avid NEXIS offers to meet the demands of today's fast turnaround, high-scale, and broadcast workflows, Avid NEXIS systems should be configured as mirror-capable. This makes it quick and easy to create mirror workspaces now or in the future to enable non-stop workflows for all types of critical workflows.



APPENDIX: AVID NEXIS ENTERPRISE ENGINE TYPES AND HOW TO DEPLOY A MIRROR-CAPABLE SYSTEM

Avid NEXIS Enterprise engines scale from the compact Avid NEXIS | F2 on up to the high-density Avid NEXIS | F5. The following table provides an overview of each Avid NEXIS Enterprise engine’s attributes.

AVID NEXIS ENGINE TYPE	NUMBER OF MEDIA PACKS	CAPACITY	RACK SIZE	NETWORK INTERFACE	IDEAL FOR...
Avid NEXIS F2	1	60, 100 or 140 TB	2U	10/25Gbps Ethernet	Smaller configurations
Avid NEXIS F2X	1	60, 100 or 140 TB	2U	10/25Gbps Ethernet	Expanding F2 for mid-size configurations
Avid NEXIS F5	4–8	240, 480, 400, 800, or 560, 1,120 TB	5U	50Gbps Ethernet	Highest density, highest scale
Avid NEXIS SDA+	N/A	N/A	2U	10/25Gbps Ethernet	Metadata controller, file system host; required for mirror protection



Avid NEXIS | F2, F2X, and F5 engines, as well as the System Director Appliance (SDA+), can be configured with redundant controllers. Avid recommends that all configurations, especially mirror-capable deployments, be deployed with redundant controllers in the SDA+. This minimizes any workflow disruption due to a controller switchover in the SDA+.

If all workspaces have mirror protection, it can be a cost-savings trade-off to deploy the engines with a single controller. However, if some workspaces are 2-Disk or 1-Disk Protected and not mirrored, it is recommended that you deploy redundant controllers in all storage engines, in addition to the SDA+. Avid NEXIS offers many redundancy options and configurations. Redundant storage controllers deployed with 1-Disk or 2-Disk Protection provide automated switchover in the event of a storage controller outage. The workflow is paused for 2–5 minutes while the storage managers and associated Media Packs are restarted on the newly active controller.

Avid NEXIS Enterprise engines are typically configured by calculating the number of Media Packs to deliver the bandwidth required. While a workflow that requires 12 Media Packs could be provisioned as 12 Avid NEXIS | F2 engines, or six F2+F2X combinations, or two partially-populated F5 engines with six Media Packs each, it is better to deploy this with 12 F2 engines, six F2+F2X combinations, or three F5 engines with four Media Packs each—plus an SDA+—to make all of these configurations mirror-capable. Similarly, smaller configurations should also be

provisioned with at least three engines with the same number of Media Packs and an SDA+ to allow mirror-protected workspaces to be provisioned.

Avid NEXIS Mirror Protection is per-engine; mirror blocks are always created on a different engine to the primary media block. This provides protection against a whole engine becoming unavailable. The overall bandwidth available during an engine failure is reduced by the bandwidth of one engine. To examine that concept with the previous example, a configuration with 12 Avid NEXIS | F2s, six F2+F2X combinations, or three partially-populated F5s with four Media Packs—each equating to a total of 12 Media Packs—is reduced by one engine-worth of bandwidth when an engine is offline. Therefore, the total bandwidth required to support the overall workflow should be considered.

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