



Broadcast Video Servers Redefined



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Abstract

In the 1990s, the move from the familiarity of analog VTRs and the stability of robotic tape playback systems to new digital video server-based playout systems represented a speculative—if not risky—shift for early adopters. Among other considerations, achieving reliability was then, as now, of enormous significance when designing or upgrading a broadcast facility. A wholesale change to a compelling but essentially unproven technology (e.g., asynchronous IT processes applied to real-time broadcast delivery) brought with it a degree of risk that was required to pave the way for the rest of the industry to move forward. Today, a similar shift is under way in the universe of video servers—but this time, the risk is far less daunting.

Introduction

Though early definitions of the term "video server" varied widely—a system could comprise a computer with a hard disk, an internal bus, and a video processor—the technology evolved to encompass standard components regardless of manufacturer. These unifying elements include generic storage disks; controllers for I/O channels along with interconnection with video and data equipment; and some version of a standard operating system.

From this foundation, server manufacturers branched the components out to incorporate multiple ingest or playout channels; choices of network-connection bandwidths and protocols; alternate video formats; expanded storage arrays; greater data protection; additional resolutions; and the ability for production systems to use the video server for storage during editing. Extending utilization further across processes, manufacturers would provide another vendor with links to their devices via SDKs (software developer kits) that the third party could use to program integration of the video servers with its own software or hardware.

These features and capabilities accelerated acceptance in the broadcasting industry. The technology began to prove itself in each new application, and video servers began not only to supplement tape libraries, robotic systems, and archives, but also to replace them throughout the facility. Emerging production workflows based on nonlinear editing with robust shared storage and asset management infrastructures accelerated their adoption further. As video servers eventually became the sole repository for ingest or playback of media, they were often deployed with no other back-up system, so high availability was essential. The more broadcasters trusted this technology to store, manage, and play out

media in complex operations at mission-critical points along the production path, the more they demanded failsafe systems.

Along the way, several approaches were taken toward eliminating the weakest single points of failure and providing the robustness required by broadcasters. Many have become standard over time. Today these will typically include redundancy of nearly every available active component—from power supplies and cooling fans to network connections and the media within the storage disks themselves—via different RAID schemes (for Redundant Array of Independent Disks). (See "The Value and Cost of Redundancy," below)

Even the most redundant systems could fail, so many broadcasters have chosen to protect their on-air operations even further at any cost, by duplicating first the channels within video servers, and then even the video server units themselves. It's no surprise that adding new channels becomes even more expensive when it also means duplicating all the components internal to the server—and then adding a second, identical video server chassis to back it up.

As the adoption of IT-based infrastructures has become more widespread in broadcast operations, the enabling technologies—processors, RAM, disk storage, and interconnection fabric—have become more powerful, more refined, more affordable, more stable, and more mature, to the point where today the problem of reliability in a mission-critical setting can be solved in newer and better ways.

The Value and Cost of Redundancy

One of the hallmarks of today's video server is its claim to dependable, airtight reliability. Server manufacturers have gone to great expense to ensure fault tolerance and to provide no single active point of failure, such that when one component fails within the hardware, another will seamlessly pick up the task. The most popular servers in the broadcast market, such as the Avid AirSPACE™ video server manufactured until 2005, typically include at a minimum:

- Dual hot-swappable power supplies
- Dual cooling fans
- Dual power entry points
- Dedicated SCSI controllers for each hard disk drive
- Hot-swappable disk drives
- RAID-1, -3 or -5 disk protection scheme

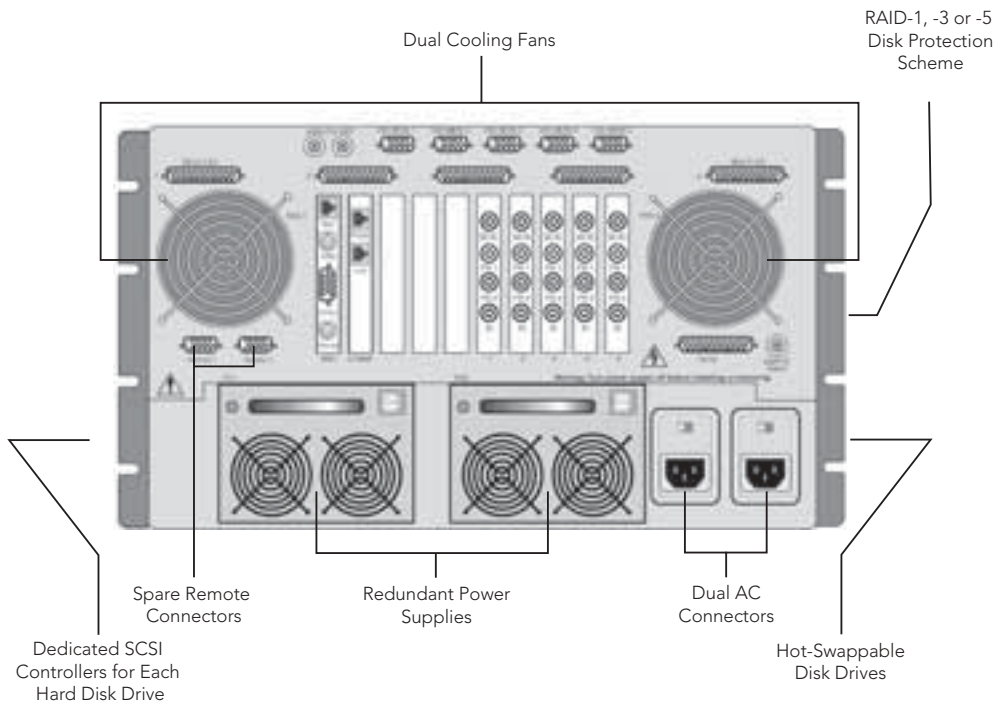


Figure 1

A conventional video such as the Avid AirSPACE Server is built with many redundant components.

Add in the ability for event payout to be automatically available to a second channel should the originally assigned payout channel become inoperable—and in some cases even the automatic protection of the file system, operating system, and metadata—and the entire system is duplicated within a single box. This type of system-wide redundancy can give broadcasters a high degree of confidence as well as the server uptime that is indispensable in a television station.

However, the hardware and software engineering and components necessary to achieve this level of availability within the chassis do not come cheaply, and can deal a major blow to the bottom line of the facility's budget. With technology advancing as far as it has since the introduction of the video server, and pressure to contain operating costs as strong as ever, broadcasters must find more intelligent, more affordable and more flexible ways to ensure the signal remains on the air—better ways to make reliability a seamless part of the broadcast infrastructure.

Redefining the Video Server

Today, a breed of video server is being introduced into the marketplace that addresses the critical issue of reliability while incorporating significant new benefits. Broadcasters have demanded a level of flexibility that traditional video servers don't meet—solving, for instance, the necessity to add multiple channels when only one more is required, which has made it expensive to scale incrementally.

New efficiencies in broadcast production have also pressured manufacturers to rethink the video server status quo. The legacy video server typically performs as a "bit bucket," dependably doing its job of holding media until commanded to play it out. However, the migration to nonlinear production workflows has brought with it the requirement to capture, track, store and protect not just media but also metadata throughout the entire lifecycle of a production asset. Considering that servers are utilized heavily from the capture of media in a television station right through transmission, better integration with the workflow—and not just occupying a box "hanging off" the network—has become mandatory.

What kind of server platform, then, can answer the needs of the forward-looking broadcast facility, while providing the best of both worlds—a solution to provide robustness, together with the innovation and interoperability required to build upon an efficient, capable broadcast infrastructure?

Introducing Avid AirSpeed

The Avid AirSpeed video server is the synthesis of proven technology with powerful new capability. Built upon the foundation of the reputable workhorse Avid AirSPACE video server and boosted with state-of-the-art IT components, it takes advantage of advances in storage, media formats, processing speed, and networking technology, and makes them more capable and more affordable than before.

The AirSpeed system is a direct ingest or playout device for the Avid Unity™ family of shared media networks, providing the LANshare, MediaNetwork, or Avid ISIS™ system with a single channel of ingest or two channels of playout via SDI. It is remotely controllable through GigE or RS422 connections, utilizing standard automation commands such as the Louth protocol as well as Avid's PAPI interface, Sony BVW extensions and MOS support for event playlists. Configured for ingest, it provides immediate access to feeds for all connected users mere seconds after the start of recording media. If it's used for playout, both channels are configurable to output DV25, DV50 or IMX50 resolutions. The most cost-effective and efficient means both at the start and finish of getting a story to air, Avid AirSpeed redefines the broadcast video server.

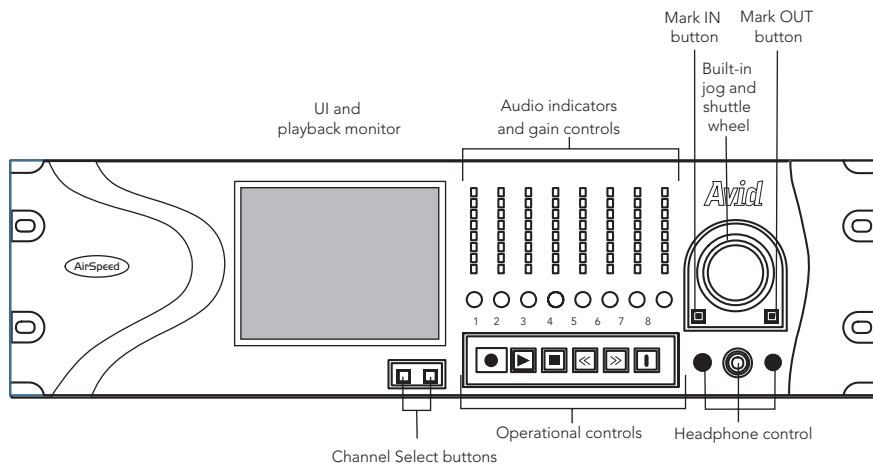


Figure 2
 The Avid AirSpeed bridges proven video server technology and advanced IT capabilities. A familiar VTR-like interface is available for some versions of AirSpeed.

The Avid AirSpeed Advantage

Efficient and integrated

The architectures of many video servers don't accommodate many of the demands of a real-time nonlinear production environment such as the Avid Unity for News media network. With Avid AirSpeed systems, direct ingest to Avid Unity shared storage without additional transcoding steps—means that all editors can begin simultaneously editing any single feed, or all feeds, within seconds after recording starts. AirSpeed systems remove the time lag between acquisition and production, creating a continuous, smooth process and facilitating the transition into editing.

Format-Flexible

AirSpeed easily handles multiple video formats in a variety of bandwidths to integrate into a facility's existing workflow, including DV25, DV50, IMX30, IMX50 and uncompressed SD MXF as well as 1080i/59.94, 1080i/50, and 720p/59.94 HD with the DNxchange® coprocessor.

Affordable to own, affordable to scale

Normally, incrementing the channel count is prohibitively expensive, since the video server is configured with multiple channels. In order to increase, for instance, from a six-channel configuration to seven, another six-channel server is required. This "n+1" scalability challenge is solved with the Avid AirSpeed system. Since the cost is the same for each additional channel (or pair of channels, in the case of playout) in an AirSpeed unit, that makes it both more predictable to cost out adding future channels, and easier to configure atypical channel counts—not to mention more economical simply to add a channel whenever needed. Additionally, the affordable cost of the AirSpeed server, in conjunction with the enormous bandwidth reserves of Avid Unity media networks, makes possible the simultaneous ingest of more high-resolution video channels at a much lower cost than was previously possible.

HD expandable

Certain versions of Avid AirSpeed may be combined with the companion Avid DNxchange hardware device in order to encode uncompressed HD media in real time into high-efficiency Avid DNxHD® media. This combination expands AirSpeed's format support and enables the capturing of high-definition footage into much more efficient file sizes with the storage and bandwidth footprint of uncompressed SD media. For playback, the process is reversed as editors use the "Send to Playback" command to move Avid DNxHD material to AirSpeed and out through DNxchange, transparently converting it back to uncompressed HD formats for air. This combination also provides a mastering-quality HD workflow on existing standard-definition SDI networks and routers.

Figure 3

DNxchange in an AirSpeed high-definition ingest and playout SDI workflow.

Input HD signal

Incoming HD SDI is converted to Avid DNxHD and transported in an SDI stream.



Output HD signal

Media for output is sent to DNxchange and converted to HD SDI.



Depending upon customer needs, AirSpeed is available with front-panel control or with remote operation only; higher-capacity drives in the remote operation model provide more internal storage. A Remaining Capacity indicator is included in both models; the amount of disk space in percentage and time remaining on the internal drives is now embedded on the marquee at the bottom of the LCD UI screen, and is viewable in the Pilot and FlightPlan I/O Peripheral applications as well. (Learn more about I/O Peripherals on Page 7.)

Software upgradeable

As video formats evolve, facilities need the flexibility to easily adopt or add new formats, without purchasing all-new hardware. Broadcasters can install AirSpeed video servers today with their industry-standard formats, and just upgrade the software codecs when new formats, resolutions and compression schemes become available and grow with the station's requirements. This type of flexibility can come into play as greater varieties of codecs become more widespread in broadcast production.

Ease of operation

The AirSpeed system can be programmed and operated from a simple LCD front panel (if equipped), or controlled using standard VTR transport controls and automation protocols. Its familiar UI requires less training and results in reduced opportunities for manual error. Over-the-network control applications give desktop users freedom from the feed room, with the ability to control operations and manage event lists from any desktop on the network using peripheral I/O applications such as AirSpeed FlightPlan and AirSpeed Pilot, as well as iNEWS® Command in any MOS newsroom environment.

Extended access

Direct shared storage is as accessible to feed room operations as it is to the connected editing clients. This means feed room operators can be as much a part of the production workflow as editors and journalists. In the front-panel controlled model, users may easily mark IN and OUT points and scan incoming video with conventional jog and shuttle knobs while viewing SD video in the LCD screen. In an Interplay workgroup, any desktop user can add crucial metadata instantly during ingest using the Avid Interplay™ Assist application. Annotations and locators added during capture are automatically visible to editors, eliminating time-consuming information searches before work begins.

Enhanced production process

Material captured using Avid AirSpeed is automatically checked into the Interplay database for easy search of ingested assets, bringing all attached clients (editors and non-editors alike) the power of integrated asset management right in the production process. Additionally, Interplay Low-Res Encode can be utilized simultaneously to capture low-resolution material as the high-resolution version is captured by AirSpeed. The flexible Avid CaptureManager™ system controls the recording of video material in single or dual resolutions; all associations and metadata are linked to the same master asset across all versions—regardless of resolution or format. Users are able to use the resolution that is appropriate for their system and task, and edits performed on one version will be the same on all versions.

For faster workflows and reduced bottlenecks, AirSpeed includes expanded support for Frame Chase™ Editing: nearly all Avid workgroup and MXF-capable editors can begin editing SD and HD material as it is being captured with AirSpeed (or with AirSpeed in conjunction with DNxchange).

All of the ways that the Avid AirSpeed system extends the capabilities of the traditional video server will provide a gamut of efficiencies and other new benefits to broadcast

facilities. However, when getting the picture to air without fail is the prime consideration, reliability eclipses all of them. AirSpeed video servers deliver on this as well—with an innovative yet straightforward new architecture.

The Studio Concept: Playout Redundancy without Barriers

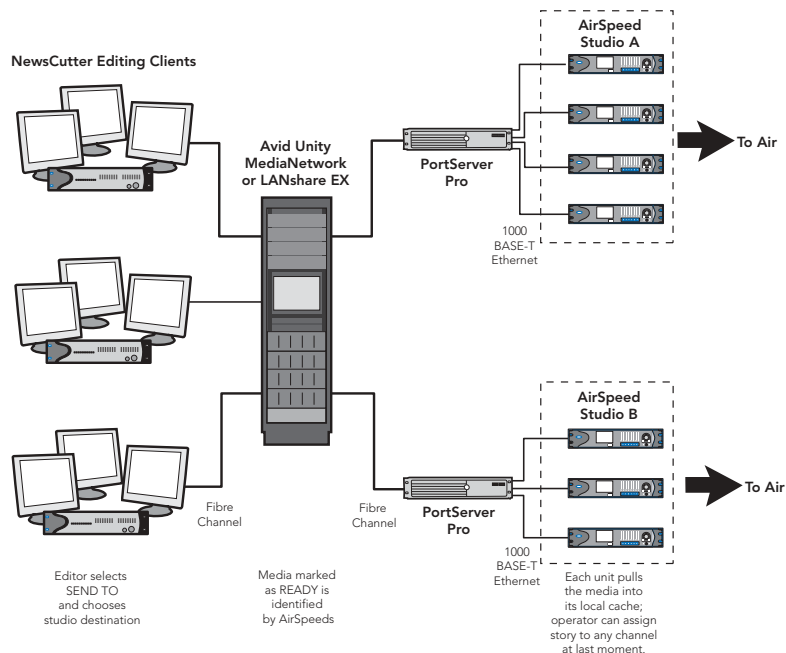
With the AirSpeed system, Avid introduces the AirSpeed Studio concept for the highest possible availability of media during playout, providing greater redundancy and flexibility through deployment in multiples. The Studio concept enables a group of AirSpeed units to be recognized by the system as a single playout entity, all sharing a single "pool" of media and playing events out accurately—regardless of whether any of the channels or units fails to operate.

Configuration

A group of up to four AirSpeed servers for a total of up to eight channels is joined together in a virtual "Studio," defined by each unit's individual and Studio IP addresses. When a "send to playback" command is invoked from the standard menu of a NewsCutter® editing system, each AirSpeed server in the target Studio pulls the designated media from shared storage into its internal cache. A fifth AirSpeed unit may be configured as a failover unit; see "Flexibility," page 9.

Figure 4

Grouping AirSpeed units in various "studio" configurations gives broadcasters redundancy and flexibility in playout operations. Note: when used with Avid Unity ISIS, Fibre Channel connections and PortServer Pro systems are not required.



Function

Thus material can now be played to air from any of the AirSpeed servers in a Studio.

This has multiple ancillary benefits. Primarily, it means that if one of the AirSpeed units fails, the same material will be played from any other AirSpeed server for accurate, instant event playout regardless of unit failure. The second benefit is that this configuration allows the operator to make decisions at the latest possible point in the workflow about which piece will play on each channel, for the utmost in flexibility or last-minute operation, based on the status of a channel or the particular workflow of the station.

Flexibility

In addition to redundancy of the media per server, the Studio concept enables the administrator to provide an entire failover unit to supplement the available channels in case of a unit failure. In the maximum configuration, four AirSpeed servers plus a hot spare are identified as the Studio. Broadcasters may, of course, build Studios with fewer than the maximum 8-channel-plus-failover configuration. In any case, whatever units are available will have media available to them for the greatest playout accuracy.

With the introduction of the Studio concept, the AirSpeed system represents the bridge between the reliability that is emblematic of the traditional technology broadcasters rely upon and all the workflow and capability advantages offered by the new breed of video server.

IsoSync: Synchronized Capture

IsoSync is a new companion application included with the system as part of the I/O Peripheral package of enabling applications for AirSpeed. In addition to the introduction of IsoSync, the I/O Peripherals shipped with AirSpeed include AirSpeed Pilot and AirSpeed FlightPlan, used respectively for controlling playback or recording across the network, and managing clips and events located on an AirSpeed.

As the newest utility, IsoSync adds greater capability to complex ingest workflows. IsoSync allows users to select several AirSpeed units, each connected to a different external source such as an isolated (ISO) camera, all to begin recording at the exact moment so that each source is recorded with matching time codes. Its highly simplified UI consists of a visual representation of the connected AirSpeed devices, and an easy-to-see red button to begin the synchronized capture of multiple isolated sources. This is a key application for studios using multi-camera recording and is a capability for other workflows including sports production wherein multiple feeds require identical time codes.

Figure 5
The easy-to-use IsoSync
user interface.



Conclusion

As broadcast infrastructures move toward nonlinear schemes that rely upon modern IT design, the broadcast video server has also evolved to incorporate more capabilities, while riding the curves of technology and affordability. Because the Avid AirSpeed video server takes advantage of breakthroughs in networking capacities, video file formats, inexpensive disk drives, and real-time shared storage, broadcasters are now finally able to realize a high level of reliability and gain workflow efficiencies with an unprecedented and always appreciated characteristic: affordability.

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