The evolution of digital storage

Feb 1, 2007 12:00 PM, BY BERNIE WALSH

The broadcast industry is reaching a milestone in the evolution of digital technology. First, there were individual digital applications, usually at the high end of post production. From there, broadcasters used digital acquisition, editing and manipulation, albeit often using proprietary formats and interconnecting through SDI — a dedicated video-style interface. Now, the industry is finally recognizing digital video and audio files for what they are — data.

As a succession of ones and zeros, they are identical to any other data in any other computer application. We need to treat them as such. Think about how it would affect your work if you applied this exclusionary attitude to all data. What if your spreadsheets needed to run on separate computers, networks and servers from your e-mail, or your documents in Microsoft Word needed to be decoded to raw ASCII before they could be passed on to someone else? This would clearly be unacceptable.

But it happens in most broadcast environments today. If, for example, you have a file in a Grass Valley server and you want to get it into an Avid editor, you have to decompress the file to SDI, pass it over a real-time connection and then encode it into the new format. It is only now that the barriers are being broken down and open standards allow ready interconnection.

The purpose of this article is not to talk about these open standards and file interchanges, but to look at what happens when open transfers become possible. Once you have a facilitywide system that can exchange digital files as data, with each broadcast application being able to share common content, then the logical step is to provide a central store for that content.

Layered storage

The traditional IT approach to centralized storage is to create a hierarchical view of the system that includes:

- *online* — expensive spinning disks with high throughput for immediate delivery of data;
- *nearline* — less expensive spinning disks that can move content to the online server quickly when required;
- *archive* — a tape or optical disk library system that takes content from the nearline disks when capacity is an issue; and
- *offline* — shelved storage of tapes or optical media when the archive system is full.

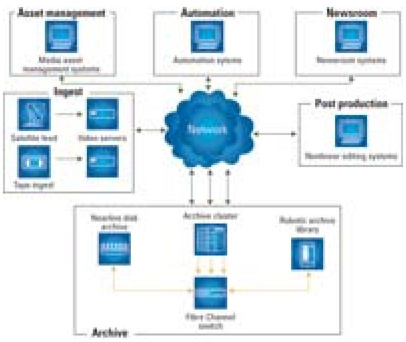
Figure 1. Storage has a hierarchy of performance and cost. Tapes on shelves may cost less but need manual handling.

From top to bottom, those four levels decrease in convenience and access speed but also decrease in cost. (See Figure 1.) The art of the system designer is to achieve the right capacity at each stage to meet the service level requirements at the minimum cost.

Broadly speaking, this is a good way to visualize the overall structure of a video content storage management system. That is not to say, however, that a standard IT storage management system will meet broadcast requirements. Television has specific demands to consider.

First, some applications have higher priorities than others. Most obviously, playout has to be at the top. If the content is not available on the playout server at its scheduled time, it's not an inconvenience; it is a disaster.

Second, the storage management system has to be transparent to the users it supports. (See Figure 2.) Whether it is an editor in an Avid suite or a scheduler preparing the final playout rundown, users simply need to ask for content and be confident that it will be delivered, where they need it, when they need it. Users should not need to worry about where their content is within the central storage or about the mechanics of how it gets to where they want it.



Third, the rules concerning how and when content is moved between levels of storage are much more complicated than how recently it has been used. For example, every broadcaster has content it needs to be able to air instantly in an emergency, but this content is not used on a regular basis. Alternatively, content that was used recently can be archived (a news story that has reached its conclusion, for example).

Figure 2. A storage system has to serve many different user types. Click image to enlarge.

The critical issue is to design a system that is based on the business and the service levels you require. A guarantee of five nines (99.999 percent) availability means designing resilience, bandwidth and throughput into the system. Through this, you can determine your service level agreement and the consequent return on investment.

As already noted, a central storage system will normally be spread across multiple layers. The broadcast application itself (editor or playout server, for example) will have its own local storage. In some products, this will be a buffer store (the local disk on a nonlinear editor, for example). Other broadcast applications have sufficient capacity and their own network capabilities to provide what is, in effect, an online server.

System architecture

Because it has to look like a single system to the applications, the temptation is to design the storage management with a single server to manage it. In servers, broadcasters have three key needs:

- the ability to expand the content storage network, both in terms of connectivity to delivery applications from broadcast to Web and mobile and in terms of storage capacity itself;
- a guarantee that the data throughput will meet current requirements and grow as the network expands; and
- security, in that the system will be highly resilient to failure and that the data itself will be protected by redundancy.

It is only by understanding these issues and the need to meet them that you can make sensible decisions on systems architecture. In particular, I believe that this rules out a single server architecture, as there are distinct limitations under each of these three key headings that severely restrict the ability of the system to meet real-world requirements. At worst, it is a single point of failure; at best — with mirrored single servers — it demands operator response to initiate manual processes in the event of failure. A clustered architecture provides significant benefits in operational flexibility, resilience and, ultimately, cost of ownership.