

How to Select a Cardiology Archival System



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Today, most cardiology departments accept that their film-based cath labs and VHS tape-based Echo labs should be converted to a filmless tapeless environment. The majority of systems implemented store an electronic pictorial record in a central image library and share a common database. Some departments go even further expanding their archive to include Nuclear Medicine studies and other modalities.

When evaluating potential archival solutions the following key areas should be considered:

1. The Nature of Connectivity

The most widely accepted method of connecting to the cath lab or Echo machine is via a DICOM connection. While most vendors today provide a 512 x 512 DICOM output spigot, the DICOM standard does allow for a 1024 x 1024 output matrix. In fact, some vendors already offer a high resolution DICOM spigot with their x-ray systems and others will follow suit in the future. It is important to ensure that the archival solution being selected, especially for the cath lab, is capable of supporting a high resolution DICOM interface. In cases where a DICOM output is not available or possible, a digitizing solution is quite acceptable. The digitizer must be capable of interfacing directly to the high resolution output of the digital system without having to utilize either a down scan or refresh rate converter.

In the Echo lab, a digitizing solution is not acceptable since it can result in degraded image quality, and it does not support the electronic transfer of measurements recorded during the procedure. Most Echo machines provide an optical disc storage device when a DICOM interface is not available. Rather than use a digitizer to acquire echo studies, the ability to read the Echo machine's storage device into the archive presents the best alternative to a DICOM interface.

2. The File Server Configuration

Most conventional network designs include a central file server to coordinate the flow of patient data throughout the network and to the stations attached to the network, in addition to handling the task of writing patient data to a long-term archival device. When the central file server fails, the flow of patient data over the network ceases. The ideal archival solution requires that the failure of the file server will not impede the ability of the system to transfer patient information from one location to another, even if the file server is not available.

3. System Reliability and Redundancy

System reliability, including fail safe redundancy, should be a critical factor in selecting an archival system. A non-critical file server design as described above contributes to overall system reliability. The use of acquisition stations to interface to the cath lab, even where a DICOM spigot exists, considerably increase the system's uptime by creating a distributed network capable of buffering several weeks of patient data. Hardware redundancy within each station and on the network also helps to ensure increased uptime and data integrity.

4. Long-Term Storage Media

The most common long-term media used today is MOD and DVD. MOD technology has been available for several years and has matured into a stable and reliable storage solution. MOD, which is available in a WORM (write once, read many) configuration, provides 91 Gbytes of storage per disc. A variety of jukebox configurations are available, starting at 20 discs and increasing to 1050 discs per library.

DVD technology is relatively new. DVD technology is available in two configurations: DVD-R (write once) and DVD-RAM (rewritable). Only one vendor currently supplies DVD-R for both media and drive. The media is available in a single sided 4.7 Gbyte capacity, although there are plans to introduce a dual sided 9.4 Gbyte capacity. DVD-R jukeboxes are available in two configurations: 100 disc and 700 disc libraries.

DVD-RAM is currently available from several manufacturers as a dual sided media totaling 9.4 Gbytes (4.7 Gbyte capacity per side). A number of jukeboxes offer a built-in flipper to allow two-sided access. Today's DVD-RAM media provides read/write capability. Therefore, DVD-RAM discs can be erased, altered or re-written. The read/write characteristic of the media may cause concern with respect to the regulatory requirements for long-term data storage.

5. External Access to Data Over the Internet

The most viable solution available for access to patient files is the use of an Internet "Web Server." This technology requires the user to access the Web Server directly (not via a third party Internet service provider), utilizing the Internet as the communication vehicle. The technology department of the hospital controls data security. The Web Server accepts any DICOM patient data and converts it to a standard format (e.g. JPG or AVI) which may be viewed utilizing any web browser and media player.

The availability of JPG and AVI formatted files at the Web Server also provides a fast and cost effective intranet capability. Diagnostic quality patient images are instantly accessible for viewing at every Review Station without having to wait for image downloads.

6. System Features and Capabilities

Most of today's archival systems provide the basic functions of storage, retrieval and review. An archival solution should include the ability to seamlessly integrate Cath, Echo, Nuclear and other modalities into a single patient database for both images and reports. Multi-modality solutions must provide for a common patient database, common archival jukebox, and a common viewer.

Moreover, the system's features should provide for increased productivity and efficiency in both reviewing and reporting cases. This is accomplished through features such as automatic pre-fetching of historical patient files, side-by-side comparison of historical and current data files (imaging and reports) and serial comparison of multi-modality cases, all without the use of proprietary software.

A comprehensive and logical final report for both cath and echo also contributes to improved productivity. An archival system should offer a final report that includes the following components:

- Autopopulate with the patient's demographics
- Autopopulate with measurements and hemodynamic values
- Autopopulate with selected images
- Provide for automatic replay of image loops embedded in the report
- Ability to publish the reports on the Web

Reporting programs may also utilize artificial intelligence to identify medical conditions based on abnormal results posted to the patient medical record or report. Advanced archival systems are already being designed to incorporate artificial intelligence into their review capabilities.

Summary

These are just a few of the key elements that should be considered when selecting an archival solution for the cardiac cath lab. While each of these elements is significant, perhaps the most important consideration should be the flexibility, expandability and upgrade potential inherent in the system design. The one guarantee in the process of technology selection is that the hardware and software will be continuously changing and improving. A system that allows these improvements to be easily incorporated at minimal cost will keep the cath lab on the leading edge of technology for years to come.

For More Information

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