The Universal Medical Viewer

Selecting Technology to Meet Your Needs
INTRODUCTION
Can a medical image management system please all of the people all of the time? Maybe, if it includes a high-quality universal image viewer—particularly one that evolves with the hospital’s changing needs.

Today, the nature of image viewing is changing. The concept of dedicated technology residing on a single workstation and tied to a particular departmental solution is rapidly becoming a part of the past. As the need—and legislative mandate—to share images across departments, multi-site enterprises and entire communities expands, a more flexible vendor neutral viewing system that provides anywhere, anytime image access is rapidly becoming an expectation.

Specifically what is a universal image viewer? To some extent this depends on who you ask and what universe they inhabit. Essentially, a universal viewer is a single platform supporting the visualization of medical images in any format—both DICOM and non-DICOM—and imaging reports that can run on any off-the-shelf computer or universal device in any location to support the workflow of any physician, as the enterprise requires. In other words, it makes images available wherever, whenever and to whomever needed. The solution eliminates the need for users to log into a specialized radiology PACS or other departmental system to view imaging data, as well as the patchwork of specialized solutions often used to provide image access beyond the department that created the imaging data. Such a viewing solution may replace or coexist with a traditional PACS viewer and may be integrated with a vendor neutral archive (VNA) or electronic health record system (EHR).

Not surprisingly, the requirements of a universal viewer for a small hospital are often relatively modest compared to the needs of a large, multi-site institution operating in an expansive imaging environment with digital radiology, cardiology, laboratory, ophthalmology and wound care files, a broad network of consulting clinical specialists and referrers covering a large geographic area. To satisfy all its needs and make the most of its budget, hospitals must truly understand their full

Executive Summary:
In today’s rapidly evolving healthcare environment, the need for cross-department and cross-enterprise information sharing is greater than ever before. This is particularly true for diagnostic images. A universal medical image viewer meets this need by enabling viewing of any medical image, imaging report and related patient data anytime and anywhere outside of a PACS environment. At last digital image access is no longer confined to the department that created the data.

However, all universal viewers are not created equal. This whitepaper examines the attributes of a universal viewer, viewing use cases, and the features and functionalities available in the technology today. It provides a valuable guide for medical professionals charged with the task of evaluating viewers and selecting one to meet the medical facility’s needs.
ATTRIBUTES OF A UNIVERSAL VIEWER

Today, hospitals can easily find a high quality image viewing system that is feature-rich, easy-to-use, versatile, secure, and affordable. Some systems actually deliver performance similar to a standard standalone PACS viewer—with all the bells and whistles. But not all viewers are created equal. So a hospital must understand its needs, survey the marketplace and make its choice carefully.

Best of Breed Solution

The best universal viewing solutions provide a range of advanced functionalities that will enable versatile image communication now and as a hospital’s needs expand in the future. These include:

- Zero-footprint browser-based technology to view all standard and less-common DICOM files for every imaging modality.

- Viewing of all standard and non-standard DICOM images from other medical specialties such as cardiology and pathology.

- Display of additional image formats, such as jpeg, tiff, avi, mpeg, often used for laboratory, ophthalmology and other images.

- Viewing textual reports.

- Support for the IHE XDS profile.

- Server-side image processing.

- Support of a full range of hardware and platforms, including PC and MAC, as well as Android, BlackBerry, iOS, and Windows.

- Support for all standard Web browsers, including legacy technology.

- Streaming technology to make the most of available bandwidth.

- API for easy integration in other clinical systems.

- Scalability to accommodate a large user base.

UNIVERSAL VIEWING USE CASES

A universal viewer enables radiologists and clinicians to access patient images and reports when needed, realizing faster diagnoses, therapy decisions and enhanced patient care. The technology supports a variety of other important use cases. These include:

- Image viewing across the enterprise outside of a PACS solution through a VNA or other enterprise-class archive.

- Image-enabling an electronic medical record (EHR) solution.

- Cross-enterprise image sharing for collaboration and second opinions.

- Cross-enterprise image sharing for trauma transfers and other emergency cases, enabling decision-making on a case before the patient is transferred.

- Referring physician image access, typically through a physician web portal.
• Image viewing across a health information exchange (HIE).

Not every viewer is the best selection for every one of these use cases, and technology choices must be predicated on every site’s needs. Hospitals should be sure to identify a system robust enough to meet all their demands today, with an eye towards future needs. But remember, users can also make the most of their budgets by making wise choices and not paying for features they will never need.

**BENEFITS OF A UNIVERSAL VIEWER**

By providing immediate access to all physicians who need images, a universal viewer can significantly enhance patient care by speeding diagnosis and increasing treatment efficiency and precision. These viewers also provide convenience and efficiency to all staff involved in using or facilitating access to images, streamlining hospital processes and procedures. They play a large role in enhancing communication with referring physicians.

**TECHNOLOGY OVERVIEW**

Today, most universal viewers are browser-based, employing some form of thin-client or zero-footprint technology that downloads from a central server or off-site cloud environment, which is part of the system. This enables use on a wide range of devices in multiple locations with minimal or no updates on these devices.

Images to be accessed can be either cached on a universal viewer server or streamed to the server directly from archiving systems like a PACS or a VNA. Users then access the server through a web browser and interact with the application and imaging data remotely—the computing power lies on the server hardware, not the local device. The best viewers do not download images to the device, minimizing security concerns. When viewing an image, an authorized user will log into the application with secure authentication protocols, find the desired image and continue from there. The device’s connection, whether wired or wireless, also is an important ingredient in the mix. Secure and fast connections are a must for high performance.

However, note that Web-based viewers may use a browser for image display, but can still employ proprietary technology, limiting the usefulness of the images. At times, vendors are less than literal with their descriptions—so buyer beware.

**Thin Client vs. Zero-Footprint**

The early wave of universal viewers was based exclusively on thin-client technology, with most of the viewing applications running from a server. A plug-in or download of various sizes on the viewing hardware was required. Today, many universal viewers continue as thin client applications. During the past few years, some vendors have progressed to a flavor of zero-footprint technology that still requires installing Adobe Flash software on the device. Few solutions require absolutely no software on the viewing device. One solution that requires no device downloads is Claron’s family of Nil pure zero-footprint viewers.

From an IT perspective, thin client technology can create a complex and difficult to maintain IT environment. IT departments need to support the portions of the viewing solution running on remote devices in what is often an uncontrolled operating environment—an iPhone or tablet, which may be treated casually compared to an in-house viewing environment.
system. Also, upgrading and maintaining the resident portion of the viewing software across multiple devices controlled by the user may become difficult and frustrating.

Therefore, a zero-footprint solution offers tangible advantages over thin client technology. But on the down side, it can demand a compromise on advanced features. The issue, in part, is the ability of the user interface on a local device to control an application running on a remote server quickly and efficiently to manipulate images as desired. Some vendors, such as Claron Technology, have invested significant efforts in making the most of wireless bandwidth to enhance performance and to integrate the most sophisticated viewing functionalities into their systems. Therefore, the viewers deliver the best of both worlds.

FEATURES AND FUNCTIONALITIES
Whether to deploy a thin-client or true zero-footprint universal viewer is just one decision. Next, technology purchasers must look closely at a viewer’s features and functionalities and consider the following:

Non-Diagnostic and Diagnostic Viewing
Most universal viewers support non-diagnostic image viewing only. Few viewers can manage the large data sets involved with diagnostic display. However, some systems, such as Claron’s Nil, do offer both alternatives. Hospitals that need support for full fidelity diagnostic images should carefully investigate the options offered by the system under consideration.

Image Manipulation
When looking for a viewer, examine your image manipulation needs carefully, and think ahead into the future. The image viewing toolsets built into universal viewers vary widely. Many offer basic functionalities such as pan, level and zoom, but the selection is smaller when it comes to advanced features such as MIP and volume rendering as well as advanced measurement tools such as ellipse, contour, ROI, and Cobb angle. A few viewers, such as Claron Nil, will also support full dynamic cardiology exams with multiple synchronized cine loop and multimodality oncology fusion. If users want PACS workstation-quality performance, it does exist. So make sure you select the appropriate solution.

Image Sharing
Some image use cases call for transmission of actual image files to a remote location, instead of simply enabling remote viewing. These cases include trauma transfers and other transfer patients with existing images that need to be added to the patient record. Certain universal viewing systems will support this data transfer in a highly secure fashion – without a VPN. If you need to view images in the scenarios above, look closely at the features each vendor offers.

Ease-of-Use
Ease-of-use is always desirable. But, what is user friendly to one physician may be extremely limiting to another. Viewers such as Nil offer versions to meet the needs of different user groups. NilShare viewer is designed for referring physicians, while NilRead (currently under FDA review) supports diagnostic viewing and offers more sophisticated features. These include
hanging protocols and advanced measurements. To streamline use, also look for a consistent workflow across different devices. Well-designed solutions will work consistently and intuitively across multiple devices and take full advantage of platform features, such as gestures on smartphones and tablets.

**Cost-Effective Technology Features**

Industry standard web protocols (secure HTTPS) without the need for VPNs and software downloads such as Flash on client devices keep costs low. Also crucial is the ability for the viewer to run in a virtualized environment without any special GPU acceleration. This will allow hospitals to host the universal solution in their data center or with a cloud provider in an affordable and scalable way.

**Security and Authentication**

Since images are not downloaded to individual devices that can be lost or casually used, server-side technology on its own provides a large measure of security. However, in an uncontrolled mobile environment, security and authentication requirements are far more stringent than in a hospital setting. A system leveraging industry standard web protocols like secure HTTPS enhances security while greatly reducing the user’s security management costs.

Support for single sign-on in a hospital’s specific security environment is important. Many institutions will find Windows integrated authentication suitable, but those using other authentication methods should look for a universal solution such as Nil that can delegate authentication to support existing methods. Typically this is through an open API to an external system. Also important is the system’s ability to grant secure temporary access to users without requiring a permanent account to facilitate collaboration with external partners. Lastly universal solutions must log into an audit trail for all access and significant operations.

**Image Pre-Fetching and Streaming**

To speed viewing, images are often pre-fetched and saved to the cloud server based on an anticipated need. Some systems support sophisticated user-determined pre-fetch rules that automatically access required images. This particularly benefits physicians who must review priors along with current studies. Additionally, Clarion’s Nil can be configured to automatically perform pre-fetching during evenings or off hours to minimize network traffic. When anticipating the need for images in advance is not possible, look for a solution that can stream images directly to remote archives. The best solution will support this with no impact on workflow.

**Privileges, Roles and Groups**

To enforce security measures and HIPAA regulations, some viewers allow users to be categorized and granted viewing rights based on these groups. These considerations are extremely important for referring physician communication, trauma transfer, and other collaborative efforts. Nil, for example, provides maximum flexibility and rules-based definition of privileges. It grants administrators a full set of user privileges including management of the user group function itself. Remember, customization and easy assignment of privileges for roles and user groups can be crucial.

**Maximizing Available Bandwidth**

A universal viewer’s adaptability to varying bandwidths is a must. Displaying large images from different modalities in various formats (eg. 2D to
MPR, 3D and fusion) in a pure zero-footprint viewer is a difficult technological challenge, particularly over a wireless network. This calls for technology optimization based on available bandwidth. Also important is the ability for a browser to work smoothly across a number of different latencies—the time it takes for communication between the universal device and the server. Latency increases with the physical distance between the client and server, and can be extremely variable with wireless connectivity. Look for experienced companies with smart-streaming technologies to address the issue. Also attend to the speed and smoothness of the viewing experience. Ideally these should be similar to a desktop system.

**Scalability**

Identifying a system that can support a site’s anticipated number of users and image volume is a major consideration. Server configuration plays a key role in this. Servers may be hardware-based or virtual, and high-volume facilities may require several. If so, load-balancing technology will help assure images are available to all users when needed.

In addition, servers are required to interface with the image archives storing the remote viewing data—whether simply a PACS or possibly an enterprise VNA or XDS data source. With Nil, data from all these sources can be federated and streamed in real time or pre-fetched as needed. In these cases, patient consolidation is important, and sites using an eMIP (Electronic Master Patient Index) to reconcile patient identifiers must make sure their universal solution supports this. If you are planning an ambitious installation or one that will grow in the future, make sure your remote access vendor offers a robust server set up that will meet your needs.

**CONCLUSION**

A universal medical image viewer is becoming a necessity in today’s healthcare environment with its emphasis on information sharing and abundance of multiple mobile devices used in healthcare. A wide range of universal viewers are available with significantly different capabilities, from simply providing access to non-diagnostic access to images beyond a PACS to highly sophisticated support for diagnostic quality viewing with a full range of image manipulation tools and the ability to transmit data files in real time. A medical facility should carefully assess its imaging needs beyond the radiology department and the enterprise to determine what features and functionalities it needs in a universal viewer today and in the foreseeable future. It should also carefully examine the capabilities of a full spectrum of such viewers to find the technology that meets its specific needs.