

## PACS Vendor Questions

### The Importance of Web-based vs Non Web-based Solutions

#### 1. Is the PACS Web-based?

**Why is this important?** Web-based PACS represents the single greatest advancement in the world of PACS since PACS was pioneered in the early 1990s. If you observe the trends in core PACS architecture, there are no more advanced architectures than those of the Web-based PACS vendors. In contrast, there remain numerous PACS on the marketplace that are actually remnant systems of the earliest PACS (from the early 1990s) with multiple user interfaces, operating systems, databases, etc.

The PACS dinosaurs replete with hybrid architectures [Note: Also called legacy PACS; Web-enabled PACS; or vendors will coin new marketing terms such as “Web-deployable” architectures that don’t mean Web-based, but they mean a lesser derivation that is really a Web-enabled client/server approach with an appended Web server, but in the absence of a Web-based system they hope to confuse the buyer.] work, but they are much more difficult to implement, maintain, integrate to, expand and upgrade down the road. Why? Because the inherent complexity of the system requires significant attention to detail. There’s no other way around it. The legacy PACS vendors have become very adept at these systems and have built large corporate infrastructures to deal with their nuances, and to stay on top of the needs of their customer base. These PACS work, but the overhead required to support the corporate PACS infrastructure is very large indeed and gets defrayed back to customers in more expensive PACS procurements, maintenance expenses (e.g., perhaps dedicated (full-time) local vendor support) and upgrade costs.

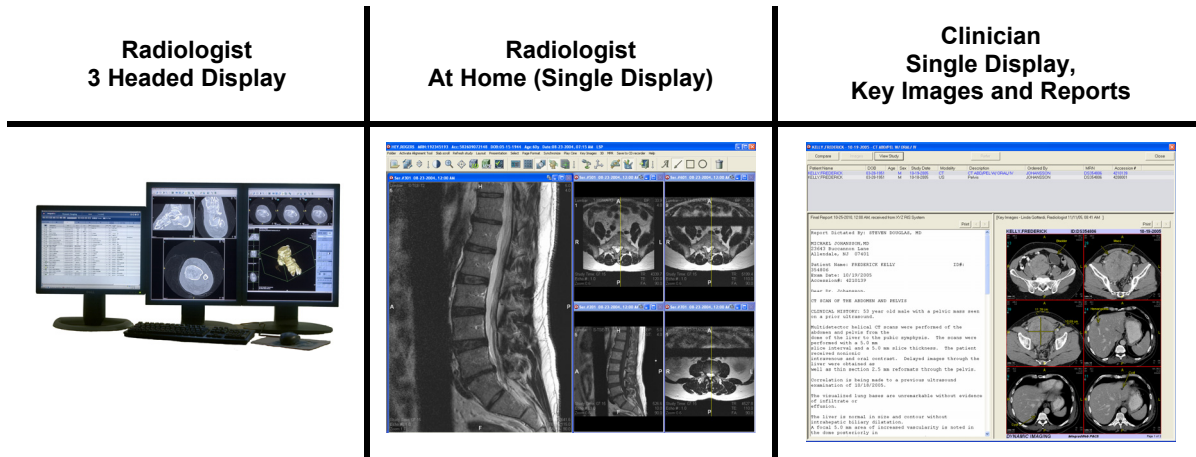
In stark contrast, Web-based PACS most often offers a simple architecture. Single operating system. Single user interface. Single database. Single production server that **IS** a Web server. The best vendors enable all studies to be online forever, regardless of their age, to be available for review or comparison from anywhere in 1-2 seconds. Other Web-enabled approaches (e.g., those with an appended Web server) have their own databases for their Web servers and only keep a limited subset of studies online. So that means the end users will have to wait for images if they are not resident on the separate Web server. This frustrates referring physicians and will undoubtedly limit their ability to effectively view studies over the Web, even if the same user interface is available as with the main PACS. Plus, if a separate database is used for the Web server, then patient demographic changes that happen on the main PACS may not update the studies on the Web server. This could cause patient safety issues or could ‘ghost’ studies on the PACS due to invalid patient demographics.

Web-based PACS has unique benefits for specific end users that are outlined below:

**Radiologists** – The best Web-based PACS offer true anywhere access to all applications. This means that a radiologist could log into the PACS from any PC in the world that has access to the Internet. But not just basic access...Access to the explicit personalized workflow that is defined by their user profile...Access to all of the embedded tools of the diagnostic workstation, to include embedded 3D, orthopedic templating, voice recognition, document management, etc. You see, it is no longer sufficient to just give a radiologist basic remote image access with ‘any old’ viewer. On the best Web-based PACS, they get accustomed to working with a single visualization tool and get incredibly frustrated to use different user interfaces (with non-Web-based PACS) just because they may be at the imaging center down the street, or at home, or at an Internet café. You also may know the havoc firewalls and security restrictions cause for accessing client/server applications and non- Web-based PACS. True Web-based PACS should not have these problems. Web-based PACS is a liberating experience for radiologists and truly empowers them to deliver top-notch care without limitation, from wherever they are.

**Referring Physicians** – The best Web-based PACS offer referring physicians the premier experience of being able to view images the same way radiologists view images. This helps radiologists conduct phone consultations with referrals, provides the same viewer on CD for referrals, and the PACS can even e-mail referrals immediately when results are available with an encrypted link to launch the Web-viewer from anywhere. Plus, if the facility has an electronic medical record system (EMR), the EMR can launch images via single-signon, and the end user can bring up any patient study they are authorized to see within 1-2 seconds. Non Web-based systems that only have access to a subset of studies on their appended Web servers may need to retrieve the study from a long term archive which extends image access perhaps to minutes. Who wants their

referring physicians to become frustrated accessing images? That is a self-defeating approach to building your referral base.



**IntegradWeb PACS: Web-based Enables the Same User Interface, For All Users, At Any Location**

**PACS Administration** – PACS Administrators never had it so easy with Web-based PACS. No client software is required to get any user started, that is why any PACS stakeholder can access a Web-based PACS from anywhere in the world. They simply click on the proper URL, authenticate themselves and like with any other Web application, the Web server sends all of the requisite software over the Web to their PC. And for the best Web-based PACS, this applies to the embedded software applications as well, like 3D, orthopedic templates, voice recognition, document management, etc. In the past, a PACS Administrator would have to physically carry an install CD to every physical PC or diagnostic workstation to load the proper software and set the proper configuration. With a Web-based PACS, all of these limitations are a thing of the past.

The best Web-based PACS allow PACS Administrators to have a PACS administration workstation wherever they logon, at any PC, wherever. They can troubleshoot from home, at the imaging center, at the hospital, or on a cruise ship in the Mediterranean. The same is the case for quality control workstations. With Web-based PACS, every PC should be able to be a QC workstation. This empowering solution helps to maintain a humming PACS, and leads to happier end-users.

By having a far less complex architecture, all of these stakeholders are happier users. Happier users lead to faster system adoption, quicker filmless operations and a *contagious* culture that thrives on timely access to images and reports to dramatically improve patient care.

Sure, a non-Web-based PACS will work. But compare a Web-based and non-Web-based approach. Let's assume your institution is faced with a limited set of human and financial resources to manage the PACS. This is reality, so your ultimately choice will result in an *opportunity cost*, one way or the other.

If you estimate you have, for example, 100 hours of time to dedicate to PACS resources (See below table), why spend the lionshare of time (80-90 hours) dedicated to simply keeping the PACS running? Sure, your users might be happy, but they don't know how hard you're working and only realize it when they see the PACS is not optimized – perhaps not available everywhere, perhaps hanging protocols and worklists aren't customized like they should be, perhaps there are not enough displays deployed across the enterprise (ED, OR, ICU, remote), and perhaps no 'PACS tuning' has been done.

In contrast, consider a Web-based PACS that may, in comparison, only require 25 hours to keep the system running smoothly. Consider what can be done with the remaining 75 hours? Everything that was mentioned before and more. Like developing expansion plans, actually spending time revisiting training for users, meeting with referring physicians to accelerate use and adoption, enhancing DICOM modality worklist integration, rolling out enterprise CDs, extend marketing of the PACS, etc.

Based on all of the above, Web-based PACS is an empowering alternative to the restrictive, resource intensive, and technically challenging approach of legacy PACS.

|                       | Daily Activities   | Estimated Daily Time Required           | Approx Minimum Use of '100' Hours | Remaining Time |
|-----------------------|--|---|-----------------------------------|----------------|
| <b>Legacy PACS</b>    |  |   | 80-90 Hours                       | 10 Hours       |
|                       | Monitor PACS Operations  | Extensive                               |                                   |                |
|                       | Rescue "Ghosted" Studies                                       | Extensive (In Absence of HL7 Interface) |                                   |                |
|                       | Maintain Pre-fetch Rules                                       | Extensive (Where Required)              |                                   |                |
|                       | Respond to Help Desk Calls                                     | Extensive                               |                                   |                |
|                       | End User Training/Retraining                                   | Extensive                               |                                   |                |
|                       | Get studies to proper destination for reading                  | Extensive                               |                                   |                |
|                       | Sustain Modality Uptime  | Extensive                               |                                   |                |
|                       | Validate Studies Archiving Properly                            | Extensive                               |                                   |                |
|                       | Maintain Interfaces  | Extensive                               |                                   |                |
|                       | Lengthy User Customization – Worklist, Hanging Protocols, etc. | Extensive                               |                                   |                |
|                       | Reset HL7 Queues   | Extensive                               |                                   |                |
|                       | Deal With Vendor   | Extensive                               |                                   |                |
|                       | Monitoring of Network  | Moderate                                |                                   |                |
|                       | Load Balancing   | Moderate                                |                                   |                |
|                       | Restart Services   | Moderate                                |                                   |                |
|                       | Synchronize Databases  | Moderate                                |                                   |                |
|                       | Fix Failed Sends   | Moderate                                |                                   |                |
|                       | Repair Workstations  | Limited                                 |                                   |                |
| <b>Web-based PACS</b> |  |   | 25 hours                          | 75 hours       |
|                       | Monitor PACS Operations  | Limited                                 |                                   |                |
|                       | Rescue "Ghosted" Studies                                       | Extremely Limited                       |                                   |                |
|                       | Maintain Pre-fetch Rules                                       | Not Applicable                          |                                   |                |
|                       | Respond to Help Desk Calls                                     | Limited, More Valuable User Experience  |                                   |                |
|                       | End User Training/Retraining                                   | Limited                                 |                                   |                |
|                       | Get studies to proper destination for reading                  | Not Applicable (On Demand)              |                                   |                |
|                       | Sustain Modality Uptime  | Limited                                 |                                   |                |
|                       | Validate Studies Archiving Properly                            | Limited                                 |                                   |                |
|                       | Maintain Interfaces  | Limited                                 |                                   |                |
|                       | User Customization – Worklist, Hanging Protocols, etc.         | Limited, For Optimization Only          |                                   |                |
|                       | Reset HL7 Queues   | Limited                                 |                                   |                |
|                       | Deal With Vendor   | Limited                                 |                                   |                |
|                       | Monitoring of Network  | Limited                                 |                                   |                |
|                       | Load Balancing   | Not Applicable                          |                                   |                |
|                       | Restart Services   | Limited                                 |                                   |                |
|                       | Synchronize Databases  | Not Applicable                          |                                   |                |
|                       | Fix Failed Sends   | Limited                                 |                                   |                |
|                       | Repair Workstations  | Limited                                 |                                   |                |

**Administrative Overhead Comparison of Web-based vs. Legacy PACS**

## We Care For Your Image

2. Does the PACS offer a single operating system?

**Why is this important?** Similar to administration of multiple databases, the more operating systems that are utilized, the greater chance for product instability. Some products in the marketplace are remnants of first generation PACS systems that utilized client/server architectures with an appended Web server, off board teleradiology systems, and separate viewers for CD viewers. These systems were hodgepodes of Macintosh, Unix, Wintel and NT operating systems. These architectures imposed significant complexity onto the system design to the point where even mundane system downtime events required 'crack' teams of experts to bring the system back up. Similarly, the greater the complexity in a PACS, the more difficult integration to third party applications become (due to potential resource conflicts) and the more challenging upgrades are to pull off without experiencing any problems.

3. Does the PACS offer a consistent user interface across all visualization products (i.e., diagnostic workstation, Web viewing, teleradiology, CD viewer, etc)?

**Why is this important?** A single user interface reduces learning curve for end users, eases implementation, and minimizes continuous training requirements. It also eliminates end user frustration with having to learn multiple user interfaces, and makes it easier for referring physicians to communicate with radiologists while looking at the same images for their patients. A radiologist could easily talk a referring physician through the same interface, but would have great difficulty (and frustration) walking them through multiple interfaces.

Minimizing interruptions is the name of the game for radiologists and PACS. The more referring physicians have an excuse to interrupt radiologists (e.g., different user interface, frustration using the user interface, general confusion), the less efficient the radiologists will be reading off of PACS, guaranteed. That means slower report turnaround time, less cases being read and frustrated referring physicians and radiologists. There's no 'win' in that scenario.

4. Does the PACS offer a single database?

**Why is this important?** The more databases that are resident in the PACS, the greater the chance of developing synchronization issues. This is especially true when brokered solutions are in place to connect to HIS/RIS systems and can highly influence system downtime.

5. Are all studies available on-line?

**Why is this important?** When studies are all online, end users should be able to access them anywhere, regardless of their age, within 1-2 seconds from any tool – direct over the Web or via the EMR. If a portion of studies are offline, then they may need to be manually retrieved, or even if they are automatically retrieved, they may need to be streamed to the desktop which can takes minutes for even average sized studies.

6. Does the PACS utilize industry standard JPEG 2000 compression and support DICOM, HL7 and IHE initiatives?

**Why is this important?** The more standards a PACS supports, the greater interoperability, the faster the system will be able to be implemented and the more apt the vendor will be to keep the PACS architecture and viewing features fresh to address market demands. This is especially true for regional health enterprises that thrive on the need for interoperability, scale, and seamless accessibility. In contrast there are some Web and non Web-based vendors that use proprietary streaming algorithms and compression tools. This is all the more important with healthcare regionalization, the increasing prevalence of Regional Health Information Organizations (RHIOs), and national health information network initiatives.

7. When burning studies to CD, can the CD allow the following:

- a. Burning of both DICOM and JPEG 2000 studies?
- b. Burning of a self-launching viewer (on any PC) that is exactly the same as the diagnostic workstation, Teleradiology and Web viewing visualization applications?
- c. Burning of images and reports?
- d. Burning of a viewer that allows side by side comparison of studies resident on the CD?
- e. Burning of a CD that includes an included DICOM Push utility to upload the studies into any DICOM destination?

**Why is this important?** With PACS, the only means to effectively go filmless is to provide seamless access to referring physicians and clinicians wherever they need images. So that means on the hospital floor, at their offices, in the EMR, at their homes, and wherever they may be. For patients, this means not carrying around heavy films, but carrying around convenient, lightweight CDs that have all of the information their physicians

require: current images and reports, prior images and reports and the same viewer the radiologists use to interpret the studies. Most non-Web-based PACS utilize a different viewer on CDs than is used by radiologists, or the viewer included on the CD may have the same user interface, but it is a sorely stripped down version of the available toolkit. The two most frequently used *generic viewers* on CDs (by non-Web-based vendors) are the eFILM viewer and RadWorks.

What referring physician would not want the ability to review comprehensive key images of 3D reconstructions and ortho templates from a CD prepared by the radiologist (and/or orthopedist)? What referring physician would not want the ability to compare current and prior studies (and reports) from a CD? In today's market, every radiology practice is looking to further differentiate themselves. Most referring physicians would like to decide for themselves how much or how little to use in terms of PACS features. And when they don't have that option from the PACS, rather, the PACS dictates a stripped down experience for them, they are less likely to be satisfied with the tools and may have a lesser perception of the service provided by the institution.

The last two pieces of importance with respect to CDs are the types of files burned to CD. CDs have become the defacto method of transport from one institution to another, bridging the so-called "last mile" for PACS institutions. CDs need to not only include the resident information required for the referring physician, but it also must be accessible beyond the viewer included on the CD. The reason for this is because many institutions would like to upload the images to their own PACS for comparison purposes, for surgical consults, or perhaps for storage due to a patient moving to a new geographical area. The problem is the vast majority of CDs store the files in a proprietary format or just as JPEG 2000 files that can't be uploaded into a 'foreign' PACS. This is further complicated by the fact that most PACS have a hard time pulling or uploading images from 'foreign' CDs.

To solve this problem, the best Web-based PACS vendors have done two things. First, they've burned two types of files to the CD – both DICOM and JPEG 2000 for maximum flexibility and portability. Second, they have included a *DICOM Push utility on every CD* so that any PACS or workstation can be pushed the images from the CD regardless of their own native limitations.

Better yet, optimal vendors will support IHE's Portable Data for Imaging (PDI) profile, which ensures CD import/export by vendors that have successfully tested and implemented against the IHE PDI profile. The IHE PDI Profile is in its second year of implementation, first having been released in 2004. What PDI allows is for a facility to take an IHE PDI compliant CD, produced by one PACS vendor's system, and easily import (upload) that study in a very standards-based way, to another PACS that is IHE PDI compliant. It's that simple when the IHE standards are available, and utilized by the PACS vendors on both sides of that CD "transaction".

This level of portability completes the filmless puzzle when it fits. If it does not fit due to the PACS being non-Web-based, and CDs that are proprietary, then the CD loses its maximum potential. When this happens, the practice is less likely to be totally filmless for some outside providers may still request film, or request DICOM query/retrieve access to the PACS to gain native access to images. However, not all PACS support DICOM query/retrieve and not all PACS administrators like to grant third party access to their local systems.