Modernize PACS Infrastructure with a Clinical Data Archive

A vendor-neutral archive on open Intel® architecture enhances enterprise-wide access to imaging information, facilitates clinical collaboration, and improves the costs and manageability of PACS infrastructure.

Executive Summary

Advanced picture archiving and communication systems (PACS) and radiology information systems (RIS) enable medical professionals to quickly and efficiently access the data needed to make accurate clinical and operational decisions. Moreover, replacing legacy and often redundant PACS/RIS platforms with modernized systems can take the strain off IT departments, allowing them to leverage a flexible open architecture.

A modernization solution composed of PACS/RIS with a vendor-neutral archive (VNA) and Intel® technologies offers hospitals standards-based interoperability that enables DICOM images and clinical data from proprietary systems to be stored in a standard format and filed under an enterprise master patient index. The archives may also include zero-footprint viewers, providing image display capabilities from anywhere on the network.

Intel technologies offer a scalable, high-performance platform for security-enhanced operation of PACS, electronic health records, and other critical information systems. VNAs built on open Intel® architecture provide interoperable imaging-system access and can help reduce costs, increase efficiencies, and deliver a higher quality of care.

The resulting efficiencies and information sharing can improve workflows as well as outcomes related to more-informed clinical and business decisions. Healthcare providers, payers, pharmaceutical companies, and life science research organizations can benefit through such improvements, with better coordinated care, increased customer satisfaction, and reduced TCO for imaging infrastructure.

Figure 1. A full-function, standards-based, vendor-neutral archive solution can display DICOM images from diverse systems on a zero-footprint universal viewer, along with data from electronic health records and other sources.
**Business Challenge: Improve Access and Economics of Medical Imaging**

With populations aging, payment models changing, and chronic conditions on the rise, healthcare organizations must deliver higher quality care more efficiently to more people. This creates a need to coordinate care across a network of hospitals, clinics, and other organizations.

Systems that can’t provide a high level of care in a sustainable fashion let down patients, employees, and partners. They also risk incurring cost penalties, along with the loss of patients to more responsive healthcare systems.

Electronic health records (EHRs) and health information exchanges (HIEs) enable secure information-sharing throughout the extended healthcare enterprise. However, medical images are generally housed in inflexible, proprietary picture archiving and communication systems (PACS) and radiology information systems (RIS) silos. While effective for primary users, they are ill suited to collaborative, patient-centered care. PACS housed images require additional effort to share with departments or institutions that deploy a different PACS/RIS solution. In addition to diminishing productivity, clinicians may lack the information to make well-informed decisions or collaborate effectively with colleagues.

Without a complete picture of the patient’s condition and history, clinicians may order diagnostic procedures that have already been performed elsewhere. Patients are inconvenienced and may incur risks from the duplicate procedures. Treatments may be delayed while additional procedures are scheduled. High-demand diagnostic resources may be used unnecessarily. Overworked specialists must spend time interpreting the unneeded imaging results. Healthcare costs rise; services declines.

The lack of convenient, secure access to imaging data also impedes the workflow and decision making of business analysts, quality assurance teams, and researchers. The need for IT to manage numerous PACS/RIS silos, many running on legacy or aging infrastructure, also adds costs and complexity. Each solution may require a different infrastructure and expertise to deploy and support, consuming budget, floor space, energy, and management resources that could be redirected toward innovation.

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**Cost-Effective, Interoperable Access to Medical Imaging Data with a Vendor-Neutral Archive**

Vendor-neutral archives (VNAs) provide practical, affordable, unified access to medical images from a variety of PACS/RIS platforms, as well as to other clinical data. A VNA offers a central repository for medical imaging, storing images, and other clinical data in vendor-neutral formats, while simplifying access via an open architecture.

Robust VNA solutions maximize interoperability by conforming to DICOM and other standards, as well as to Integrating the Healthcare Enterprise* cross-enterprise document sharing profile, including the Document Registry and Document Source. Standards-based VNAs use the HL7 interface and EMPI protocol to display data from EHRs and other sources. Universal viewers allow users to access images and other information from anywhere in the enterprise on phones, tablets, and other mobile devices, while facilitating HIPAA compliance. VNA solutions, which are available from a variety of healthcare vendors, allow data to be securely shared with external organizations.

**VNAs in Action**

VNAs improve information access and workflows in a variety of healthcare applications.

**Make Peer Review More Powerful**

VNA-supported peer review increases collaboration and enhances quality of care by improving workflows and removing barriers to access. For example, radiologists are using VNAs to extend peer review to cover procedures such as angioplasties. Open access to archived images in vendor-neutral storage enables healthcare organizations to choose the best tools for supporting radiology and other medical departments.

**Facilitate Regional and Nationwide Collaboration**

Clinicians can view images and other data while maintaining their preferred PACS/RIS solutions. Second opinions are easier to obtain, improving care. Workflow efficiencies increase productivity for heavily burdened radiology specialists. Patients in rural areas can obtain teleradiology services from specialists independent of location.

**Considerations for a Vendor-Neutral Archive (VNA)**

Since there are no formal standards for VNAs, organizations choosing a VNA vendor may want to discuss issues such as:

- What formats and protocols does the VNA support? How fully is each supported?
- How does the VNA store images and other data? Will the VNA support importing images from your current picture archiving and communication systems (PACS)?
- What is the process for importing PACS images into the VNA? What context management capabilities does the VNA provide? What query and retrieve capabilities?
- How does the VNA support for modifications to the originating documents? For example, does the VNA allow Admission, Discharge, and Transfer updates to image files stored in the archive?
- What storage infrastructure solutions does the VNA support? How easily does the VNA interface with business tools and databases?
- Does the VNA include a universal viewer?
Provide Comprehensive Information at the Point of Care
Using a VNA, clinicians at the point of care can view a patient’s full record, including radiology exams conducted at other facilities. Robust VNAs can build a more comprehensive medical record by bringing together varied types of exams, including those from cardiology, neonatology, and other medical specialties.

Improve Payer Workflows and Decision Making
Payers use VNAs to help confirm diagnoses and monitor treatment progress. The workflow improvements enabled by VNAs help reduce administrative overhead and allow faster, better-informed responses to customers.

Strengthen Research and Innovation
Pharmaceutical companies and healthcare and life science researchers use VNAs to perform sophisticated analytics. Combined with machine learning and other techniques, scientists gain insight through VNAs that may spark the next treatment breakthrough.

Solution Value: Improving Efficiency, Clinical Care, and Infrastructure
A full-featured VNA built on open Intel® architecture enables authorized users at healthcare provider organizations, payers, pharma companies, and research centers to more securely and affordably access medical images and other data, regardless of the originating PACS system. This approach can help improve quality of care, increase efficiencies, and reduce costs.

Enhance Quality of Care and Decision Making
A full-function VNA can offer the clinical team a single point of access to data stored on different systems. This can strengthen peer review and support the information exchange that empowers informed decision making and coordinated care. VNAs can also avoid duplicate diagnostics and initiate treatment more quickly, helping to improve outcomes, optimize resource utilization, and increase customer satisfaction. In addition, researchers, payers, and analysts can use VNAs to build a comprehensive database for developing evidence-based care plans, making operational and resourcing decisions, and creating treatment breakthroughs.

Boost Efficiencies
No longer locked into proprietary PACS systems, IT and clinicians can implement the next-generation solutions of their choice. IT can build image archives on open Intel architectures to promote security, interoperability, and scalability. Streamlined workflows increase convenience and productivity while providing health professionals access to information. Data retention policies are more flexible, helping organizations optimize their storage infrastructure and reduce costs. VNAs also help organizations build longitudinal patient records that simplify access to images and EHRs and can incorporate unstructured data such as scanned, handwritten case notes.

Reduce Costs
A study of VNA solutions, such as the Centricity* Clinical Archive solution implemented at the Southwestern Ontario Diagnostic Imaging Network, found that PACS and diagnostic imaging networks, fully implemented across Canada, could avoid 10,000 to 17,000 patient transfers and 800,000 to 1.3 million duplicate exams per year. The savings would run to tens of millions of dollars annually. Deploying VNAs with Intel® technologies also coincides with efforts to modernize the data center and lower costs.

Futureproof IT Investment
By modernizing PACS/RIS infrastructure with Intel technologies and using an open, standards-based architecture to provide image access, organizations benefit from a more agile, innovative healthcare enterprise. They also gain flexibility to accommodate changes to clinical, operational, and regulatory requirements. Other dividends include applying advanced analytics techniques to medical images that can improve everything from resource planning to pharmaceutical innovation. IT can evolve their data centers and private clouds that deliver cost efficiencies while enhancing availability, scalability, security, simplicity, and interoperability.

Solution Architecture: Vendor-Neutral Archive
An Intel technology-based VNA (see Figure 2) solution architecture emphasizes performance, scalability, reliability, and sustainability. The architecture separates the imaging and archiving layers, using individual application and storage servers to provide economies of scale. To promote HIPAA compliance, the universal viewer is a thin client, with an application server rendering the image for display.

VNAs are typically deployed with on-premises infrastructure to maintain local control. An optional hybrid configuration, which combines on-premises and external cloud-based infrastructure, can help ensure disaster recovery and business continuity.
Technologies for Scalability and Performance

Intel offers a powerful portfolio of technologies for demanding applications, including data-intensive solutions such as clinical data archives (see Figure 3). Using Intel technologies, organizations can deploy reliable, high-performance platforms designed to meet the demands of modern data centers and fast-growing databases. These technologies include:

- **The Intel® Xeon® processor E5 family** delivers performance to support growing workloads and agile data centers.

- **Software-defined storage, accelerated by Intel® QuickAssist Technology**, enables organizations to move from siloed storage resources using proprietary protocols to a common, virtualized resource pool of storage. Advanced orchestration of these assets allows for enhanced services and capabilities, such as automated hot-warm-cold tiering, deduplication, compression, and encryption.

- **Intel® Solid State Drive (Intel® SSD) Data Center Family for PCIe®** brings extreme data throughput directly to the Intel® Xeon® processor. The Intel SSD DC P3700 Series is a Gen3 SSD based on the Peripheral Component Interconnect Express® (PCIe®) and architected with the new Non-Volatile Memory Express® high-performance controller interface, to help improve performance, latency, and quality of service.

- **Intel® Ethernet Converged Network Adapters** is a 10/40 gigabit family of adapters built to address the demanding requirements of the next-generation agile data center. These adapters provide powerful features for server and network virtualization along with flexible performance for LAN and SAN networks.

Intel technology elements can help organizations optimize their clinical data archives by helping increase performance for their compute, storage, and infrastructure. For example:

- The Intel® Xeon® processor E5-2600 v4 product family offers an average 27-percent generational performance gain across key industry-standard workloads and applications.²

- Looking at its own workloads, Intel’s IT organization found that substituting SSDs for part of a server’s physical memory resulted in a 1.63-fold performance-normalized cost advantage while also reducing costs. The SSD solution also reduced the requirements for data center space, as well as for power and cooling per server.³
Taking a holistic approach to infrastructure upgrades can amplify the benefits. By upgrading storage servers with a new processor, replacing SATA SSDs with PCIe-based SSDs, and increasing the number of 10GbE network connections at the same time, organizations can help improve database and I/O performance, to reduce bottlenecks and deliver a more responsive user experience.4

**Conclusion**

As the demand for affordable healthcare services continues to rise, healthcare organizations must innovate to deliver collaborative, patient-centered care and meet the requirements of value-based payment models. PACS modernization with VNA's and Intel technologies supports these objectives, enabling organizations to manage medical images efficiently, streamline clinical and business workflows, and provide cost-effective image access to users across the continuum of care. In achieving these benefits, organizations can improve quality of treatment, increase efficiency, reduce costs, shift resources toward innovation, and build a strong foundation for a sustainable, data-driven healthcare enterprise.

Find the solution that is right for your organization. Contact your Intel representative or visit [intel.com/healthcare](http://intel.com/healthcare).

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1 See the GE Healthcare case study, “Creating the Model for Medical Image Management in Canada,” 2012. Available for download at landing1.gehealthcare.com/centricity-clinical-archive-southwest-ontario-case-study

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