Building a Sustainable Medical Image Archive and Exchange Platform

A Guide for Telehealth Networks and Health Information Exchanges
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Telehealth Networks (TNs) and Health Information Exchanges (HIEs) are most definitely not the same type of entities. They do not operate the same, nor do they encounter the same problems. However, when looking at TNs and HIEs from a technology perspective, the commonality between them becomes apparent - they both exist to enable the exchange of medical information. Whether that exchange is synchronous or asynchronous, pushed or pulled, exchange is the common technical element. With the introduction of meaningful use criteria, Accountable Care Organizations and the advent of standards for clinical data transfer, such as HL7, DICOM and XDS, electronic exchange of health information has been propelled forward in recent years.

Few networks and exchanges, however, address medical images and their associated reports as part of the exchangeable patient health record (PHR). Medical imaging is the 800-lb gorilla in the room, accounting for 60 to 80 percent of all healthcare data storage, and therefore representing the largest part of the complete PHR and the biggest challenge when it comes to exchange.

Although DICOM (Digital Imaging and Communications in Medicine) is the default standard in medical imaging, it has been co-opted by the PACS vendors and presented back with each vendor’s proprietary tags and headers, making its use as an exchangeable format essentially obsolete. Other solutions that exist today are point-to-point, non-scalable and expensive solutions. To standardize these proprietary formats, a technology trend has emerged in recent years called Vendor Neutral Archives (VNA). VNAs are extremely effective in normalizing medical images to meet accessibility and data management objectives.

Traditionally, VNAs have been reserved for larger academic institutions or large healthcare provider integrated delivery networks (IDNs). This whitepaper explores the application of VNA technology within a TN or HIE framework, making the case for a well-planned network-wide deployment of a VNA that enables the sharing of medical images regardless of originator. The proper VNA deployment is also financially sustainable with benefits that span from the small rural facilities to large urban facilities and the entire network as a whole.

About 15% of health-care systems in the U.S. are using cloud-based storage for images. - Accenture
Think Beyond Exchange

Of course the purpose of a TN or HIE is to enable the exchange of health information. However, why has funding and participation from healthcare providers in these networks been less than compelling to date? Answer: because there is no financial incentive for them to do so and no simple, cost effective way of doing it while addressing the concerns of patient privacy and data governance. They are being asked to participate out of an altruistic ideal. For most providers, the percentage of cases where electronic health information exchange is required, is relatively small. They cannot justify the needed spend based on a typical ROI analysis. Therefore, many of the networks and exchanges are still not financially sustainable today.

The challenge for TNs and HIEs is to offer a valuable service that solves a real problem, existing internally for the healthcare provider, while at the same time satisfying the exchange needs across the service area, state and nation.

Why address medical imaging?

1. It is simultaneously the largest revenue generator and pain-point for hospitals. The amount of storage medical images require is growing by an order of magnitude as study sizes increase and the use of medical imaging in diagnosis continues to expand, which is compounded by compliance requirements by individual states on the retention of images. Providers need a way to effectively manage this data in a consolidated, scalable approach.

2. We have to prepare for the required inclusion of medical images in the PHR. Meaningful Use criteria in conjunction with the Accountable Care Organization (ACO) movement will drive this initiative. We know that medical images need to be incorporated in the PHR, and the only way to do this in a clinically meaningful manner is by utilizing a VNA, otherwise the medical record will lose meaning without fully interpreted medical images.

By embracing medical imaging as a platform for a value-added service, a TN or HIE can act as a General Purchasing Organization (GPO) for the region, negotiating a complete medical image VNA service that solves problems cost effectively for both small and large participants. By solving these problems directly for the healthcare provider, TNs and HIEs can garner the support of its participants, recruit new ones, and enhance the overall functionality of their service – exchange.

InMedica predicts that imaging studies managed by VNAs will grow annually at nearly 50% over the next 3 years.
**Why create an archive and not a temporary vendor neutral exchange?**

This question gets back to the additional value that the TN or HIE needs to provide in order to make it appealing to providers – *think beyond exchange*. If exchange is the only offer, the value is limited and therefore the participation will be limited as well. Exchange of the images is a small part of the problem. Managing the storage, access (i.e. data governance and patient privacy) and lifecycle of the images is the more crucial problem that TNs and HIEs can solve for their healthcare providers.

Furthermore, a VNA offers the clinically best way to exchange images. Many solutions can exchange medical images. Technologies exist that allow DICOM and non-DICOM objects to be viewed or downloaded. However, without the clinical overlays, tags and measurements from the readings, those images have no context. A VNA maps the proprietary tags and overlays of any PACS and packages it into a neutral format that can be viewed by any system and ingested into any PACS, providing a meaningful, complete patient record that a physician can digest quickly.

Many healthcare providers are already seeking VNA technology. In fact, 27% of providers surveyed by KLAS indicate that a VNA is central to their imaging strategy. InMedica predicts that imaging studies managed by VNAs will grow annually at nearly 50% over the next 3 years. TNs and HIEs can offer this solution as a single-source to solve the provider’s internal problems while providing an ideal medical image exchange platform.

**Proposed Architecture**

There are four major components to a centralized, state-wide or regional VNA service. All components are equally important in order to provide a comprehensive strategy for a centralized VNA and image exchange platform. This entire ecosystem does not exist off-the-shelf in the marketplace. A best-of-breed approach can bring all of the necessary modules together in order to create this holistic solution.

The first component is the VNA itself. This is the fundamental layer of the system. In order for images to be exchanged freely, they must first be normalized across all systems into one standard format.
It is critical to choose the right VNA platform, one that is comprehensive, replicable across all providers, and offers the greatest amount of flexibility.

The second component is an FDA approved diagnostic quality universal viewer. This crucial element must be chosen wisely, as it should be able to present every type of study ingested into the VNA. This universal viewer enables on-demand diagnostic quality viewing of studies from the cloud and real-time collaboration, which are key aspects of an image exchange strategy. To make adoption as easy as possible, this viewer should be zero-footprint, requiring no installation of extra software on the provider's workstations.

Moreover, the right viewer will perform quickly when viewing images from the cloud. Certain technologies perform better than others in a cloud scenario. Speed is the difference, and ensuring a great user experience for radiologists and physicians alike is paramount to gaining support and adoption.

The third component is access and exchange control. Just putting images into a centralized VNA with a universal viewer is not enough if you want to be able to properly control the access and exchange of those images. An additional layer that integrates with every provider's system and controls the authentication and access into the viewer and VNA components is required. This layer indexes every study and its location, even those studies not yet ingested into the VNA that are housed in a temporary, “foreign” work queue. It enables the cataloging and searching of patient studies across the entire community. This system facilitates the workflow between patients, physicians and HIMS staff by enabling sharing and collaboration and the consolidation of audit trails for compliance purposes.

The fourth key component is a centralized management team. This market is evolving rapidly. Relying on one single piece of technology will not provide the flexibility and functionality needed in the next few years. One comprehensive and neutral service provider that can bring the appropriate tools and resources together quickly, in response to changing demands offers a complete and future-proof solution. Furthermore, this approach simplifies vendor relationship management for TNs, HIEs and the participating providers.
Deployment Models

To be successful, TNs and HIEs need to be flexible with providers, particularly as to how the VNA is deployed. Two primary deployment models exist.

Cloud
Cloud deployment, the simplest and fastest option, requires a gateway at the provider’s site, with a small cache housing a configurable amount of recent studies for fast access. This gateway replicates ingested studies immediately to the cloud system. In this scenario, the cloud system should replicate all data between two geographically separate data centers.

Hybrid
Hybrid deployment includes a full copy onsite. Similar to the cloud model, everything is replicated to the cloud as well, effectively giving the provider three copies of each study. The onsite system is also the responsibility of the provider, raising the IT resource burden with space, power and personnel, but giving the provider control over the primary copy.
Federated vs. Centralized

Fundamentally, a federated or centralized storage model will work, and utilizing the right technology allows for either. The third layer of the architecture that controls access and exchange allows a search for a patient’s data to return all results, whether they reside in the cloud, onsite, in the provider’s PACS, or even in a foreign work queue.

The advantages of a centralized system over a federated system are twofold. First is speed. Decentralizing all the storage means that every call for a patient’s data will have to search and retrieve images from disparate locations. Unlike text, which could be transferred quickly from just about anywhere, depending on where the actual image resides and the system configuration and bandwidth at that site, image retrieval could take some time. Conversely, if all images are immediately transferred to the cloud when committed to the VNA, they can be read on demand from the cloud or downloaded quickly.

The second advantage is cost. Many providers will choose to have at least one copy of their data onsite (the Hybrid model discussed above). This is mainly chosen, and understandably, for the purposes of comfort and control. However, it must be noted that this means the provider is essentially paying for software and storage twice. Although it may not be twice as much, they can expect to pay more for this deployment.

Benefits

The benefits of providing a centralized VNA to each provider can be compartmentalized into clinical and financial. These benefits encompass all providers to some degree, large and small, as well as the TN and HIE communities as a whole.

Clinical Benefits

• **Point-of-Care Access.** A central VNA and exchange platform allows for the viewing of medical images at the point-of-care, when and where it is most critical for the doctor and patient.

• **No More CDs.** No longer are patients required to physically bring a CD of their images to their attending physician, which requires the ingestion of that image by that facility into their own clinical records or a foreign work queue.

• **Eliminate Duplicate Studies.** By having the diagnostic quality images readily available, it benefits the provider and the patient simultaneously. It eliminates unnecessary radiation exposure for the patient and reduces extra steps in the diagnosis and treatment of the patient.

• **Enable Sharing and Collaboration.** Images can not only be shared, but clinicians can collaborate with specialists in real-time.
• **Clinical Choice for Imaging Departments.** By removing the “A” (Archive) from PACS, IT no longer has to dictate what vendor each imaging department has to use. Each department (radiology, cardiology, urology, gastrology, pathology, etc.) may now make the best clinical choice for their viewer and workflow. This choice is further enhanced by the fact that the imaging data is no longer held “hostage” in the PACS vendor’s proprietary format. The provider now owns that data, essentially allowing for greater PACS and viewer mobility for the provider.

• **Image Enable the EMR.** In the proposed architecture, a universal viewer allows providers to image-enable their EMR through one interface, which has both clinical and financial benefits. It allows access to images through one-central source for physicians, enhancing workflow efficiency. At the same time it requires the installation and maintenance of only one image interface into the EMR, rather than possibly several with different PACS, reducing the IT resource burden. Similarly, TNs and HIEs can image-enable their portals as well.

• **Built-in Business Continuity and Disaster Recovery.** As all providers need to plan for disaster, this service can be provided in a centralized VNA solution for the whole community. If the provider site were disabled, images can still be accessed from and routed to the cloud VNA. With the diagnostic quality universal viewer in place, imaging operations can continue to function until the onsite system has been rebuilt. Moreover, if one site in the network were disabled, patients could be transferred to other facilities in the region with their medical images easily accessible from the cloud.

• **Research.** A centralized VNA allows for expansive clinical research with de-identified data. This is currently referred to as “Big Data” analytics. Whether for private or public use, by government, academic institutions, healthcare providers or private enterprises, the benefits of research upon such a large dataset can prove immeasurable, and ultimately will come to benefit everyone participating.

### Financial Benefits

• **Economies of Scale.** One centralized archive scaled across multiple providers in a region or state can provide massive economies of scale, lowering costs in many ways. Centralized storage can be utilized more efficiently and implementation costs are reduced due to growing domain knowledge as more providers join.

• **PACS and Storage Migration Avoidance.** For providers, one of the most painful processes is the migration from one PACS or storage system to another. With a VNA, providers can avoid this cost altogether. The longer the time horizon analyzed, the greater this cost savings becomes.

• **Lowering PACS Costs.** By removing the “A” from PACS, providers no longer have to purchase separate archive storage for each PACS. This is now centralized, reducing the
overall cost of the PACS. Furthermore, since providers “own” their own data with a VNA, it gives them greater leverage in negotiating with PACS vendors, as they are now “PACS mobile.”

- **Image Lifecycle Management (ILM).** As stated before, images typically account for 60 to 80 percent of a provider’s storage footprint. With a proper VNA that enables ILM, providers can legally and safely purge old data based on configurable secure policies, helping to slow the rate of growth of image storage.

- **Eliminate Non-Reimbursable Studies.** Through the proper archiving and exchange of images, duplicate studies can be eliminated. These are studies that due to ACO requirements and other insurance programs, are less and less likely to get reimbursed. Given the sometimes enormous cost of imaging studies, this savings can be significant.

### The Business Case for Providers

The question may be asked, “Isn’t this a new cost to the providers?” The answer is no, if it is positioned properly. In dollars and cents, the VNA spend is not something entirely new. For the most part, the money spent on a VNA should be money currently spent, or planned to be spent in other areas related to medical imaging.

A VNA is such a comprehensive solution with wide-ranging effects across an organization that it is often a challenge just to identify how and when to consider a VNA approach. In many cases, there exists a “compelling event” that easily justifies the foray into VNA technology.

To help clarify, below we outline six common issues or events that most healthcare providers experience, and how a VNA platform can positively impact these situations. If a provider is experiencing any one of these events, a VNA approach may be a good fit for meeting the immediate need, while providing further value for the provider and community in other areas.

1. **PACS Migration.** If a provider is preparing to migrate from one PACS to another, a VNA should be a definite consideration. The prospect of a PACS migration is painful and expensive. Why not migrate once into a VNA, and then simply point the new PACS to it? This becomes the provider’s last migration, EVER! Any new PACS acquired in the future can interface with the VNA, and no further migrations are needed.

2. **Storage Upgrade.** At some point, the storage hardware utilized by a PACS will become outdated. Many PACS today are tied to storage platforms that vendors have announced as End of Service Life. A VNA allows providers to consolidate storage into one, more easily managed system, across all installed PACS. Furthermore, by utilizing a hosted and centralized VNA, storage becomes a future-proof archive platform with the service provider managing the storage hardware and providing it to the providers as a service, thereby eliminating any future storage upgrades and migrations.
3. **Implementing New EMR & Image Enabling an EMR.** Whether a provider is completely replacing the EMR or simply needs to image enable the existing EMR, a VNA platform can simplify the process. A VNA consolidates all medical images into one place that the EMR can reference through a single interface. Coupling this with a diagnostic quality universal viewer allows providers to offer one, zero-footprint viewer that clinicians can use to view any type of medical image. Additionally, this centralizes all access management and reporting into one system for medical images, simplifying every provider’s audit process significantly.

4. **Need for Image Sharing.** Apart from the purposes of the TN and HIE, sharing images is often an important component for meeting ACO and meaningful use requirements. It also provides a range of clinical workflow benefits as well as internal benefits to the provider. Whether it is for referral appointments, emergency care to accelerate a diagnosis or to reduce the need for duplicate studies and radiation exposure, a pre-requisite for sharing images is to first put them into a vendor neutral format that can be viewed in any PACS or viewer. A VNA platform with a built-in image sharing component can provide additional ease in facilitating and managing the access of those images inside and outside the organization.

5. **Investigating PACS Alternatives.** Depending on the provider’s needs, a VNA platform combined with the right tools can replace a PACS entirely. For example, one small, critical access facility may be using its PACS to simply route studies to and from a third-party radiology reading group. Replacing the PACS with a hosted VNA solution that includes an exchange platform and universal viewer can improve workflow and lower costs. By “deconstructing the PACS” you may be able to replace the traditional PACS with other best-of-breed tools that, when combined, can do what the PACS does, but at a lower cost and with more flexibility.

6. **Mergers & Acquisitions.** In today’s hospital environment, consolidation and divestitures are common. A VNA enables healthcare systems to quickly integrate acquired entities’ PACS without exorbitant migration costs. Additionally, they can easily centralize storage and reduce costs, thereby realizing economies of scale across the new acquisition faster.

These are just a few areas to get started. A full TCO analysis can be presented to make the case upon further investigation. Whether a VNA saves or costs money, or is cost-neutral, depends very much on the particular circumstances of each provider. However, every time it offers much more in functionality and future benefits than can be found with other solutions.
Most Common Objection by Providers:

*Why Give My Competition Access to My Customers?*

We have to be realistic. This is America, founded on individualism and free enterprise. Providers have a right to be concerned about this issue. However, this “closed-system” point-of-view does not consider the best interests of the customers (the patients).

First, consider the patient’s point-of-view. If a patient arrives at a competing facility with complications from a previous injury, and that facility needs to access the patient’s historical images in order to treat him or her properly, but access to those images is refused or delayed because of the initial facility’s recalcitrance to participate in the image exchange, what does the patient think? Should the patient be burdened by misdiagnosis or a delay in treatment because of the situation? Whose data is it really, the patient’s or the provider’s?

Shifting focus to the patient’s point-of-view is vital to getting everyone to understand who the real customer is and who is ultimately affected. Making it difficult for customers to move providers is not the answer. Providers should compete on the services that directly affect quality of care – the service, the clinical tools, and the quality of the professionals at the institution.

Furthermore, this objection is one-sided. By participating, providers are able to better treat those patients from all competing providers as well. This benefits small and large providers in a reciprocal manner. Small, rural providers gain access to specialists at larger, urban providers. Simultaneously, large, urban providers expand their patient base with the ability to assist those small, rural providers.
The Business Case for TNs and HIEs

The point in offering this value-added service is to help put TNs and HIEs on a financially sustainable path. Setting up the proper relationship with the right service provider is paramount. Ensure the organization has all the buy-in needed from provider participants, creating a service that everyone can benefit from. Create an alliance of key provider stakeholders, with the largest and most innovative providers leading the way.

Propose a business model that is not disruptive to existing operations and ensure that all providers, large and small, are able to participate. A small revenue share arrangement should work well (see Case Study Brief: CTN below). If organized properly, there should be no infrastructure costs for the TN or HIE. Everything should be managed by the service provider. The only costs associated with the service to the TN or HIE is the cost of evangelizing the solution and promoting the adoption and utilization of the service.

Exchange Use Cases

Clearly, TNs and HIEs are not the same types of entities, and they solve for different use cases. Fortunately, with the right image archive and exchange platform, all use-cases can be addressed.

First, providing image access and exchange services inside the facility itself are most pertinent to the majority of providers. This includes image-enabling the EHR/EMR. From there, this solution extends those same services to incorporate inter-facility exchange and access within the same provider’s facility and affiliate network. The next level of exchange and access then ultimately reaches inter-provider protocols and strategies that are either peer-to-peer or through a central HIE or TN service.

Legend

1 - Standalone Hospital
2 - Integrated Delivery Network (IDN)
3 - Health Information Exchange (HIE)
4 - Standalone Hospital and IDN
5 - Standalone Hospital and HIE
6 - HIE and IDN
7 - Standalone Hospital, IDN and HIE
Colorado Telehealth Network

The Colorado Telehealth Network (CTN) developed a program that will enable hospitals, imaging centers, clinics and other health care providers in Colorado to safely store and share medical images through a private cloud hosted and managed by GNAX Health on CTN. CTN and GNAX Health are working with the Colorado Regional Health Information Organization (CORHIO) and Quality Health Network (QHN) - the two Colorado Health Information Exchanges - to image-enable their physician portals so that images and diagnostic reports will be available through the HIEs. GNAX Health will also allow CTN to offer disaster recovery and business continuity solutions. In addition, electronic medical records (EMRs) can be integrated with the infrastructure to provide physicians a single interface for viewing all medical images, which is a requirement for Stage 2 Meaningful Use.

Nine CHA member hospitals worked with CTN for over two years to develop the imaging program with input from hospitals across Colorado. After a thorough RFI process and evaluation of five solutions, CTN selected a solution provided by GNAX Health through a strategic alliance with Acuo Technologies and Client Outlook. The unique requirements of the CTN program required a specific set of capabilities that is best addressed through this strategic alliance. Several use cases - such as the ability to search, retrieve and exchange medical image studies federated across CTN and view images quickly from the cloud - led to this best-of-breed approach.

“This pioneering agreement between CTN, GNAX, Acuo Technologies and Client Outlook further solidifies our network as a national leader in health information technology and connectivity. We are confident this new image-storing service has the functionality and advantages our clients deserve, and promises to significantly enhance patient care coordination and quality across Colorado.”

- Ed Bostick, CTN Executive Director
The solution combines Acuo’s Universal Clinical Platform (UCP) with Client Outlook’s eUnity clinical image visualization, sharing and collaboration toolset, hosted within GNAX’s health care-focused cloud infrastructure and tier-4 data centers - all supported by a cohesive customer support program. This collective solution provides necessary components critical to building a statewide vendor neutral archive and, subsequently, a highly secure disaster recovery and business continuity solution for medical imaging without the infrastructure and costs associated with a traditional model.

“This is a great example of a successful public-private partnership. This collaboration led to a unique strategic alliance that produces a solution unlike any others in the market. This offering tightly integrates world-class clinical content viewing, abstraction and life-cycle management applications, data migration, cloud-computing and customer support services into a single bundle, greatly simplifying the process of administering enterprise medical image access, exchange and management while reducing IT costs.”

- Jeff Hinkle, GNAX Health Chief Executive Officer
GNAX Health is also providing a web-based image exchange service for CTN, called SDEX (Secure DICOM Exchange) that is integrated into the foundation of Acuo’s UCP and utilizes the Client Outlook viewer. It meets the challenge of complicated workflows by integrating with the provider’s employee and patient identification systems to securely access and simplify patient searches. Studies can be retrieved from any of the connected PACS, local edge devices or from the cloud archive, making the location of the image transparent to the end user in addition to reducing the total amount of storage required (because images do not have to be copied in all locations to be accessible).

The benefits of the program to Colorado health care providers and patients are numerous. Patients of participating providers should no longer be required to transport their own imaging studies via CD or film. Consequently, such patients should no longer undergo duplicate studies, reducing unnecessary radiation exposure.

CTN leverages the reciprocal collaborative nature of the solution to make it affordable for all providers in Colorado. The services are available to all CTN members through flexible deployment models that fit each provider’s needs. The program is financially sustained through a subscription model based on the number of studies ingested and the amount of cloud storage required. Because the program is scaled across the entire state of Colorado, it provides cost savings for both large and small providers. The small hospitals receive an enterprise vendor-neutral archive and exchange solution at a fraction of the cost while gaining access to specialists at larger institutions for their patients. Large providers also benefit from the collaboration with critical access facilities because they can service patients they may not otherwise be able to as easily.

“This consortium brings an innovative solution based on IHE standards to CTN. We’ve worked closely with GNAX and Client Outlook to develop an implementation approach that will save CTN significant time and effort.”

- Jeff Timbrook, Acuo Technologies Chief Executive Officer
About GNAX Health

GNAX Health is a leading healthcare technology infrastructure and application delivery service provider offering hospitals, clinics, pharmacies, labs and many other healthcare organizations mission-critical datacenter colocation, managed application delivery, backup & disaster recovery, medical image vendor neutral archive (VNA) and exchange, as well as enterprise level VMware based cloud computing services. GNAX’s 75,000 square feet mission-critical datacenter in Atlanta is SSAE 16 Type II compliant with Tier-4 power and serves as its home base with an additional strategic facility located in Dallas, Texas. Learn more at www.gnaxhealth.com.