This White Paper discusses IDC Health Insights research on the use of the cloud to impact access and efficiency of clinical image storage, archiving, and retrieval. Shared cloud imaging platforms are increasingly being used by health systems across the globe to distribute images and other types of content among collaborating providers in a secure and efficient manner. These systems not only can be used as vendor-neutral DICOM archives (VNAs) to create storage efficiencies for radiology and other departmental picture archiving and communication systems (PACS) but also can be used to further enable collaboration, helping extend capabilities beyond radiology to add capabilities for the storage of and access to images from additional departments and creating a true longitudinal record for the patient. Content types may include DICOM images, as well as multimedia content types like videos, visible light photos, audio, text, and document images. Key findings from IDC research on the utility of cloud-based clinical archiving show these systems may result in:

- Improvements in the hospital’s ability to store images of more types more efficiently in a patient-centric manner
- IT being allowed to rationalize the storage infrastructure, facilitating the use of archiving and deletion policies across the organization, security and privacy, more efficient use of software and services from the cloud, storage resources, lower and more predictable cost of image storage, and less costly PACS and other clinical system migrations in future cycles
- The facilitation of improvements in the availability of imaging across departments, which can help facilitate diagnosis and treatment and reduce the radiation exposure, time, inconvenience, and cost associated with repeat tests resulting from lost or inaccessible image files
- Cloud technology that provides opportunities for health systems to codevelop with suppliers and innovate on the cloud platform, allowing hospitals and their IT staff to collaborate on product development and IT-based innovation in care
IN THIS WHITE PAPER

Methodology

This White Paper discusses the implementation of cloud-based platforms to support medical imaging applications provided by independent partners. The Microsoft Azure Storage platform and the StorSimple appliance are among multiple cloud platforms being used to leverage cloud services to support medical imaging and unstructured content storage, retrieval, and collaboration in health systems. The research for this paper included several briefings with Microsoft, briefings with other cloud platform and vendor-neutral DICOM archive and application-independent clinical archive (AICA) suppliers, and conversations between IDC and hospitals and health systems working with cloud service providers to improve access to and collaboration around unstructured clinical content in their hospitals.

SITUATION OVERVIEW

Today’s healthcare providers in hospitals and imaging centers face challenges in sharing administrative and clinical information including diagnostic images, unstructured content such as video and visible light images, and related clinical content. Many providers are questioning legacy approaches to clinical content management and the cost and operational impact of maintaining different PACS infrastructure, including enterprise storage, as well as traditional image order-centric approaches that consolidate images into VNAs. As more types of patient data and images are being shared across departments and affiliated organizations, providers seek to provide a level of transparency and information access to this data, regardless of the modality or application with which an image was created. They want to make storage of unstructured content and storage migrations more efficient and cost effective. They also seek to unite related unstructured content captured in other systems with the patient-centric information being captured in the electronic health record (EHR).

Definitions and Taxonomy

IDC Health Insights defines two main categories of technology that address unstructured content storage in healthcare, whether on-premise or in the cloud. These two approaches are the vendor-neutral DICOM archive and its successor, the application-independent clinical archive. AICA is, in many ways, a second generation of VNA. VNA evolved as a way to address the vast amount of siloed information that has been created by departments implementing PACS over the past 15-20 years.

PACS initially targeted radiology and evolved over time to support image acquisition in other departments, such as cardiology and gastroenterology. Each departmental PACS had its own method of storage and image viewing. As the use of PACS expanded across the clinical setting, and more images were amassed, managing storage and migrating images each time an application was replaced became cumbersome. The large volume of storage associated with images, and the ever-expanding need to store them, created a need to archive older images not associated with active cases in more cost-efficient tiers of storage. The PACS archive is a costly and inefficient way to store images over time. To remedy this problem, VNA was created, and commercial implementations of this technology began around 2003-2005. VNAs allow providers to retire, add, or integrate viewing, storage, and other IT solutions, instead of dealing with individual PACS vendor restrictions. VNAs are meant to serve as archives for DICOM and non-DICOM-based content and use standards to provide sophisticated
accessibility, data management, and migration features. Some VNAs in the market offer truly vendor-neutral approaches; others just aggregate multiple departmental PACS from the same supplier and still require proprietary integrations for third-party sources. Some VNA and AICA technology is structured to support and optimize on-premise storage, but providers are increasingly making use of hybrid cloud-based platforms for primary and overflow storage, as well as to facilitate collaboration involving unstructured content in cloud-native approaches.

The AICA is differentiated from the VNA by the notion of patient centricity and the shift in focus from storage rationalization to enhancing clinical relevance. In the AICA, data and images are stored and organized to form a longitudinal record of unstructured content associated with the patient’s medical treatment. AICA’s combination of clinical relevance and patient centricity adds tools and analytics — available to extract further value from data and enhance decision making in the organization — to the EHR and decision support environment. AICA makes patient data active for longer: Even older patient data stored in an AICA becomes more accessible and forms a longitudinal record that can be useful to current care delivery.

The AICA’s architecture takes advantage of standards like DICOM, HL7, and IHE for application-independent content that was developed to support VNA to provide access to and manage content like DICOM images. AICA has many features in common with VNA but expands beyond the concept to ensure true vendor and PACS-independent storage. AICA also employs many clinically oriented features that are available in some VNAs to manage policies related to patient indexing, access, retention, analytics, and storage of metadata associated with unstructured content. AICA, by its nature, represents an approach that allows for retrieval of most content in the archive, with retrieval times close to those of real-time transactional systems, as AICA is designed to be tightly integrated with EHR and used in real-time care delivery, adding clinical relevance to the data. AICA provides a single scalable repository that can contain both real-time and historical content and serve as primary and/or secondary storage for systems; it doesn’t contain only archived content. For this reason, AICA can be leveraged for disaster recovery, business continuity, and high-availability environments.

**Evolution of AICA into the Cloud**

Moving AICAs into the cloud may provide further benefit beyond the capabilities created by on-premise installations for many organizations. Today’s provider organizations are increasingly involved in accountable care delivery networks that include multiple partners in a community. Whether they are delivering services on behalf of a specific payer or network in a competitive market or delivering care on behalf of the government in a single-payer system, actors in the system are expected to work together and share where needed to improve outcomes. Patients and physicians are increasingly demanding collaboration, even outside these payment networks, as they become accustomed to ubiquitous information available for sharing from cloud-based systems in their daily lives. As our lives have been changed by mobile devices and the Internet, patients are increasingly demanding that healthcare providers also change to leverage these same technologies. Provider networks are seeking to leverage collaboration via AICA and to further extend that collaboration with AICA in the cloud.

As adoption grows, collaboration in the cloud is changing care delivery. Providers using cloud-based archives have access to longitudinal patient medical histories, images, and content captured by other providers available securely from the cloud. Accessing information from the cloud accelerates the velocity of care, as providers no longer need to wait for information or repeat tests and procedures to make good
decisions at the point of care. Care may be further improved and accelerated as providers make use of tools and analytics in these cloud-based environments and collaborate virtually with other providers in their own community and with specialists near and far. This may be accomplished via systems that are entirely cloud based or via hybrid implementations that leverage existing datacenters in addition to sourcing some capacity and capabilities from the cloud and leveraging the cloud for collaboration.

Why Cloud Content Archiving?

Historically, the business case for VNAs was based on ROI and purchasing was primarily an IT decision. VNAs allowed healthcare providers faced with daunting rates of storage growth and changing clinical PACS needs to rationalize image storage on-premise or in the cloud, to archive some less needed content into less costly tiers of storage, and to apply retention policy to restrain storage growth. VNAs also simplified PACS migrations by removing the storage from the PACS, the radiology information system (RIS), and the modality; this made acquiring new modalities and PACS easier and allowed organizations to remain compliant and keep archived images available even if the end user's platform changed to align with clinical needs. The business case for implementing cloud-based content archives includes the value proposition created by VNA and embraced by provider IT departments. AICA implementers will see the same ROI and IT benefits as VNA implementers but will accrue additional clinical benefits as a result of aggregating content beyond images and making the archive available to physicians from the cloud. Additional benefits of AICA in the cloud include:

- **More readily accessible data.** Medical imaging and other technologies are creating unstructured content at a rapid pace, and providers need to have this data easily accessible for incorporation into clinical care and analytics. Cloud-based solutions allow IT departments to implement hybrid solutions that optimize storage and indexing, while keeping content readily accessible.

- **Flexibility and agility.** The pace of change for providers today is unrelenting. Providers are forming and aligning delivery networks to support population health, patient engagement, chronic disease management, and other approaches and then realigning them to improve outcomes. Providers need to introduce flexibility and agility into their data to facilitate storage and management of image data, to make data available rapidly to a growing set of apps, and to allow for communication and collaboration.

- **Compliance.** The healthcare regulatory environment is complex, and complying with local, regional, and national requirements is a challenging endeavor. Providers also must balance the need for privacy and security compliance with the need to collaborate leveraging data.

- **Cost and ROI.** Cloud-based and hybrid image archives can be used to manage the cost of storage in an organization by reducing the capital expense or overall cost of storage hardware and software, offering more predictable costs for budgets. Cloud image archives may also improve clinical collaboration and diagnostics that may lower the cost of care and reduce the cost of efforts such as legal discovery of imaging records.

- **Expanded capabilities.** By leveraging the cloud, small and midsize medical centers can start to see the economies of scale and make functionality available to providers that historically may have been available only to large health systems and academic medical centers. Cloud-based solutions can be designed to build in disaster recovery and business continuity capabilities should unexpected events occur.
Many early implementers of AICA in the cloud have also found that the benefits of the solution go beyond the expected clinical and economic effects. Most providers get started expecting the solutions to be used mainly in traditionally image-intensive specialties, like radiology and cardiology, but find that use of the archive quickly proliferates into additional departments when the archive is made available. As these departments begin to use the archive, their siloed unstructured content is added to the repository and is available to providers organizationwide. Once a wider set of providers start to collaborate in the cloud using AICA, the platform becomes an enabler for research and innovation. The cloud-based AICA platform can serve as an enabler for other services, such as more complex workloads, big data analytics, mobile apps, and the growing array of sensors and devices that make up the Internet of Things.

**Solution Description: Microsoft Azure and StorSimple**

Microsoft Azure and StorSimple along with their partners offer a hybrid cloud storage solution for primary storage, archiving, and disaster recovery. This solution can help optimize total storage costs and data protection for healthcare providers while facilitating the secure sharing of clinical data across and among organizations. Azure and StorSimple can help healthcare providers manage the challenge of massive data growth — both from traditional sources like medical images and from emerging sources like EHRs, mobile and medical devices, audio, video, photos, and sensors. StorSimple hybrid storage arrays help end the cycle of constant capital investment by offering scalable, high-performance hybrid cloud storage solutions that make use of existing on-premise capabilities as well as capacity in Microsoft's Azure cloud. Healthcare providers can also use StorSimple to access enterprise data from the StorSimple virtual appliance and industry-leading solutions available via vertical industry partners.

StorSimple solutions available from Microsoft and its partners in the Azure cloud can be used to:

- **Facilitate clinical research.** Azure resources and partner applications can be used to conduct medical and clinical research and to access compute capacity for genome sequencing, clinical analytics, and other high-performance computing workloads.

- **Host clinical and operational apps.** The Azure cloud can be leveraged to host clinical applications like EHRs in a secure, regulatory-compliant private cloud, as well as other line-of-business applications for hospital departments like the pharmacy, the lab, the kitchen/cafeteria, and billing.

- **Enable business analytics.** Hospitals are increasingly using analytics to help understand and manage their operations amid the rapidly changing environment of global healthcare reform. Cloud-based solutions can support data management and analytics to enable clinical and financial management, including business analytics and performance management.

- **Manage medical imaging.** Medical imaging presents a key workload and more than 80% of the storage requirement in many healthcare organizations. The Azure hybrid cloud, StorSimple, and partner apps can be used to manage, archive, and index medical images from radiology, cardiology, and other departments.

- **Access critical data via the Internet of Things.** Healthcare is increasingly virtual as providers rely on mobile devices and sensors to provide data to physicians in the hospital and in patients’ homes for ongoing monitoring and management of health.

- **Support remote health workers.** The Azure cloud and Azure RemoteApp allow hospitals and health systems to support mobile health workers using tablets and specialized apps to deliver in-home care for patients.
FUTURE OUTLOOK

As healthcare reform moves forward globally, healthcare providers will continue to be faced with fast-moving change and the need to incorporate more agile, scalable technology into their infrastructure in order to bring solutions to market quickly. Requirements like the digital hospital, increased use of medical imaging, the Internet of Things, advanced analytics, and app proliferation are driving the need to incorporate cloud technology into mobile workflows in order to help providers achieve the goals of healthcare reform. The need for technology – specifically the ability to leverage the cloud – is acute, and medical images and other unstructured content represent a good opportunity for organizations that wish to begin using the cloud or broaden cloud operations. While EHRs have done well managing structured data, organizations have struggled to incorporate and use the unstructured data and images that are proliferating in hospitals and ambulatory environments. Providers need to better leverage unstructured content and incorporate it into decision making to achieve the collaborative goals of improving outcomes at lower cost and creating a better experience for patients, and cloud-based technology presents an opportunity to do so.

As healthcare reform moves forward, so will the use of cloud to facilitate tasks including image archiving. The benefits of incorporating hybrid and cloud solutions into image archives include cost, flexibility, access to apps in the cloud that use the data, security, compliance, backup, and disaster recovery, as well as recovery as a service. While all healthcare organizations stand to benefit from incorporating cloud-based technology into their image archiving environment, the benefits are particularly clear for academic medical centers and large health systems, whose research environments need to leverage large content stores for big data analytics more extensively.

Challenges/Opportunities

Cloud-based technology is not without its risks. While judicious use of cloud has a strong potential to add agility and scalability to a datacenter environment, cloud technology can raise challenges, including:

- **Cost structure.** Many providers seek to use cloud technology to reduce costs, but for many, the cost over time may be equal to or greater than the cost of implementing on-premise technology. Cloud moves the responsibility for management of infrastructure into the hands of a cloud service provider that may see economies of scale from managing the environment of many companies and pass these economies on to end users. Cloud service providers may be able to provide better performance, scalability and apps, support, and backup and disaster recovery services that are harder to deliver with on-premise technology. Moving services to the cloud may also free up resources and create opportunities for the organization that otherwise would have been lost. In addition, the resulting cost for the end user is moved from a capital expense to an operating expense, which may have a beneficial effect on budgets. Providers should move to the cloud for the transformative benefits to the business and not solely to reduce costs.

- **Security and compliance risks.** While security and compliance risks exist whether infrastructure is on-premise or in the cloud, working in the cloud introduces a slightly different set of variables. Healthcare organizations need to work closely in partnership with cloud service providers to ensure that security and compliance obligations are met and to incorporate strong service-level agreements (SLAs) into these partnerships. SLAs should address availability and uptime as well as risk mitigation for business continuity issues as well as security issues. End users need to be as vigilant in auditing security practices when considering cloud and hybrid deployments as they would be in on-premise situations and to work with providers and end users to secure endpoint devices.
ESSENTIAL GUIDANCE

Cloud adoption among healthcare providers is widespread and growing, and most healthcare providers plan to continue along the path to cloud in 2015. As healthcare providers look to move new workloads to the cloud to respond quickly to changing business and regulatory requirements, they should consider the following recommendations:

- **Look for cloud providers with healthcare offerings, plus industry experience and expertise, when sourcing cloud services for provider operations.** These cloud service providers will be more likely to understand the constraints associated with handling regulatory compliance issues and with the unique demands of vertical applications.

- **Require business associate agreements and healthcare-specific SLAs.** Best practices for constructing these SLAs should include both compliance with regulatory requirements and service metrics specific to the demands of the application and end users. For many organizations, concerns about security raise significant risk challenges. Technically, many of the risks can be managed, though not eliminated, with appropriate SLAs.

- **Manage security risk, but don't rule out cloud.** As with on-premise deployments, security issues need to be managed carefully but should not be a deterrent to cloud strategies.

- **Look for cloud providers that offer hybrid options as well as consulting, training, and implementation services to facilitate the transition to the cloud.** While external service providers can be helpful when getting started with cloud and supporting ongoing operations, the on-premise IT staff also needs to understand and develop skills to support and troubleshoot cloud environments. Organizations with a strong in-house cloud skill set will have options when making the decision to outsource or keep clouds on-premise and flexibility to change cloud service providers or bring operations in-house if desired.

- **Transition to a service-centric organization.** When making the move to the cloud, the IT organization will change. Cloud will require different skill sets, but standard services and platforms typically allow staff to retrain and specialize to support the new environment, working with cloud service providers to allow for improved service levels.

- **Set key IT goals that lead to new levels of existing IT services and new services.** Cloud should present an opportunity for the IT organization to improve service levels and offer more services to end users with the same staffing levels. To ensure that the IT organization captures these efficiencies, the healthcare provider should plan the transition to cloud and set goals for services. Unstructured content and image archives are a good place to begin the move to the cloud.

- **Continue experimentation and develop best practices related to cloud computing.** Each provider IT organization will need to experiment to determine the cloud practices that are best suited to the needs of its staff and end users. The transition in staffing and service roles will take time, and organizations should allow for experimentation as best practices emerge.

- **Evaluate and document the technical and business risks of specific workloads shifting to cloud.** Providers should weigh the benefits and risks of moving specific workloads to the cloud. The business impact of cloud is most noticeable for new initiatives as well as for high business value or highly innovative projects, where some level of customization of IT resources is critical and risk sharing creates an environment that fosters innovation.
- Exploit the capabilities of cloud to create opportunities for business, engaging business and clinical leaders in IT strategies including new cloud-enabled products and services. Optimized cloud implementations will drive business innovation through seamless access to IT resources and allow provider organizations to make informed decisions based on true cost and value to internal and external partners.
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