



# Moving Toward the Healthcare Cloud

## Step 1: Virtualization

In the matter of a few short years, virtualization has leapt from bleeding edge to leading edge. Even the most traditionally risk-adverse healthcare providers are maximizing virtualization. The reasons behind the uptick are fairly straightforward. Virtualization, and the resulting storage consolidation, delivers a host of benefits including reduced costs, streamlined IT resource management and accelerated application deployment. It's both simpler and more efficient to consolidate, the first phase on the journey to the private cloud.

## Start with consolidation

A key first step in the transition to cloud-based computing is to move away from the traditional siloed healthcare IT environment with each application housed on a separate server. In many hospitals, the enterprise houses multiple SANs for data storage. Management can be complex and resource intense with server care and feeding consuming an inordinate share of IT resources.

Many enterprises begin with the physical consolidation of servers and storage to gain IT efficiencies. As a result, the site begins to accrue benefits such as streamlined management, increasing the consistency of security controls, and providing a framework to improve service level agreements. True nimbleness and flexibility become apparent as the healthcare organization move from IT production to virtualizing business and clinical applications in the virtualized data center.

Here, savings and results gain steam. IT becomes more service-oriented, responsive and proactive, and, at the same time, business continuity and disaster recovery reach new levels. The next stage—moving to a healthcare private cloud—will require higher levels of security and compliance particularly with enhanced protected health information (PHI) requirements. This IT-as-a-service focus is offered to end-users within a defined “community” where on-demand infrastructure can be leveraged. *Health Imaging & IT* visited a trio of sites to learn their approaches to storage consolidation and server virtualization. The diverse group includes an academic medical center; a mid-sized regional healthcare enterprise and a rural healthcare system. Each of these organizations’ reasons for embarking on the journey toward the private cloud varies, but their advice is consistent. “Get on board,” they insist. Read on to learn more about how these pioneers are working in concert with their partners to leverage the operational, financial, and business benefits of virtualization.

## A holistic model of application support

Aspirus in Wausau, Wis., is a regional healthcare organization comprised of five hospitals and a growing network of independent primary and specialty care physicians. “When Aspirus started down the digital imaging path, there was no sense of the scale of digital imaging,” recalls Glynn Hollis, director of technical services. The enterprise quickly outgrew its original small disk array for digital image storage and opted to invest in an EMC Corporation Centera CAS (content addressed storage) to store archived radiology data. Aspirus also deployed a separate storage area network (SAN) for its Epic EMR and clinical management applications data.

By the mid-2000s, the Aspirus IT department realized it needed to apply the brakes and evaluate storage in a more holistic manner. At the time, the organization operated three SANs with PACS data and EMR data with corresponding file storage—each residing on an individual SAN. “We realized it wasn’t sustainable to manage individual architecture for each individual application,” recalls Hollis. Costs of the conventional server storage model had started to esca-

late with wasted CPU cycles, high cooling and electricity costs and an ever-growing footprint. At the same time, virtualization was beginning to make a mark in the server world. Hollis and colleagues began asking some smart questions:

- › Why confine the organization to the one application and /or one SAN model?
- › Why not share IT resources (servers) that are not well-utilized?
- › How could the healthcare system consolidate its storage architecture?

“We didn’t want to be pigeon-holed. We wanted the flexibility and agility to create an environment where we didn’t have to research systems and procure hardware for every application,” explains Hollis. In this innovative new model, vendors would apply their software to Aspirus’ environment rather than Aspirus needing to adapt its environment to every new application. The approach, which puts the hospital in the driver’s seat, was fairly new and required some expert assistance.

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EMC Corporation played a vital role in the decision-making process and shared a variety of successful models to help Aspirus better manage its storage infrastructure and set the stage for virtualization. Ultimately, Aspirus decided to deploy EMC CLARiiON CX4-960 storage area network with enterprise flash drives as its base storage consolidation platform. “CLARiiON CX4 offered a platform that could evolve as needed to meet our needs,” says Hollis. “It’s the base for virtualization and helps us save the time and effort required to individually manage every server. Instead, we manage at the macro level.” The healthcare network also leverages a host of other EMC solutions including CLARiiON CX3 and EMC Celerra for thin provisioning and de-duplication of storage across NFS, CIFS, and iSCSI mounted systems and EMC Centera for its radiology and cardiology PACS and its image archive. EMC NetWorker and EMC Avamar backup software provide data de-duplication and centralized, automated backup and recovery.

EMC NetWorker and Avamar were key to Aspirus, helping to relieve a pain point in Aspirus’ data growth. As Aspirus was becoming more agile in the ability to provision its infrastructure for application needs, a new challenge emerged in how to protect data such as non-linear growth data. EMC Avamar allowed Aspirus to protect its largest of data requirements with a very high degree of recoverability. This coupled with Avamar’s unique de-duplication process allows Aspirus to manage non-linear data growth and still maintain high degrees of recoverability and a consistent backup window. Leveraging EMC NetWorker to round-out the backup and recovery solution, Aspirus can still utilize legacy backup storage investments as well as

natively integrate with EMC Avamar. This creates a high degree of flexibility on determining the most appropriate backup storage point for any type of data Aspirus manages.

“EMC is more than a storage vendor,” says Hollis. “They are a partner in the truest sense of the word. They come to us to talk about our challenges and what they can do to make us more competitive and cost-effective.” EMC provided assessment, design, implementation and data migration services to help Aspirus meet current and future performance objectives.

Hollis compares the transition from siloed storage to a virtualized data center model to moving from a clerical staff to a knowledge-oriented staff. “The model takes more skill and knowledge, but it enables so much more.” Servers are managed at the macro level and not individually, allowing the site to run smoothly with a very lean IT staff. And IT can embrace a service-oriented model, where the hospital presents its problems and IT leverages architecture to help develop a solution.

For example, if Aspirus acquires a new application, forges new partnerships with other healthcare partners or creates new business ventures, the virtual private cloud leverages all of the technologies together. “Our partners come to us to leverage our resources to help them

when their physical infrastructure has reached its limits from either a server performance or storage perspective. Aspirus can nearly on-the-fly transition these physical technologies to virtual without a high-degree of business impact offering far more value than in their original state as well as a lower cost of ownership,” explains Whalen.

There are concrete results, too. After consolidating more than 300 servers onto 64 blades as virtual machines, Aspirus has realized a 25 to 35 percent reduction in power and cooling use. End-user read cycles plummeted from 12 to 15 milliseconds to 1 to 1.5 milliseconds and clinical batch processing were reduced by 430 percent after Aspirus deployed CLARiiON with flash technology for its Epic clinical system.

### More servers than beds leads to a virtualized model

Appalachian Regional Health System (ARHS) in Boone, N.C., a rural, three-hospital system serving a geographically dispersed catchment area, is a server virtualization and storage consolidation leader. Their system is about 75 percent virtualized and recently moved their Tier 1 applications to virtualized servers. “We are more confident in virtual server management than in physical server management,” says Vice President and CIO Mike Quinto.

The health system has realized impressive results since tiptoeing into the virtual environment in 2008. These include increased efficiency and reduced costs. AHRS operates an ultra-lean IT department with just 2.5 full time employees dedicated to server and storage management. “We could not maintain physical servers with this staff. Keeping storage and servers together in the cloud provides a way to do more with less,” offers Quinto.

ARHS decided to test the virtual environment in 2008 when they found themselves with 160 servers—more servers than beds. The data center was at maximum capacity, straining the cooling system and IT staff. Quinto initiated a pilot, investing in EMC CLARiiON CX 240 SAN and VMware ESX Server virtualization solution to consolidate 20 Tier 3 applications. Within several months, the health system pushed Tier 2 Windows-applications into the EMC/VMware solution.

EMC helped AHRS configure its consolidated model. In moving to the new model, Quinto aimed to eliminate as many variables as possible. “We needed support and sustainability, particularly since our IT staff members are not industry veterans,” says Quinto. EMC supplemented AHRS staff and provided assistance to help the system design comprehensive storage and virtualization solutions. With successful Tier 3 and Tier 2 projects under its belt, AHRS had become a virtualization leader.

When one of the health system’s Tier 1 applications needed a new server, Quinto realized he could

## Advice from the Pioneers

- ◆ **Healthcare is ready for virtualization and the technology is ready for mainstream.** “Don’t shy away from virtualization. Most of the architecture is proven; it’s just leveraged in a better manner,” shares Glynn Hollis, director of technical services at Aspirus in Wausau, Wis.
- ◆ **Be sure to balance technology advances with internal readiness.** Joe Bajek, CTO at University of Colorado Hospital in Aurora, Colo. cautions, “Don’t be oversold by bright and shiny technology. Partner with your internal business to understand its needs and how tech can support the desired end results.”
- ◆ **Application vendor buy-in for virtualization is not universal...yet.** Anticipate and plan for vendor reluctance, recommends Mike Quinto, vice president and CIO at Appalachian Regional Health System (ARHS) in Boone, N.C. “This is a new variable for clinical vendors to support, which creates costs and training issues for them.” A balance of hand holding and insistence does the trick at AHRS.
- ◆ **Be prepared to educate and re-educate.** After Aspirus reconfigured and updated its IT environment, C-level execs started viewing IT as a utility. “It becomes more difficult to explain why you need additional money when everything is working well. We’ve built a proactive model, and we want to stay there,” explains Hollis. Executives tend to frown on spending additional funds on utilities. Avoid the utility trap with consistent internal education.
- ◆ **Capture metrics on IT efficiencies gained on the front end.** ARHS didn’t realize its project would be as successful as it was. Establishing metrics better makes the case for a project and provides data to share with internal stakeholders and external audiences.

push their new virtualization model. After assessing the risk, the health system virtualized the application. Today, most of its Windows applications are virtualized, and Quinto will not bring an application that can't be virtualized into the data center.

After aggressively moving ahead with the virtualization strategy, Quinto says his staff agrees that the new model is easier to manage and better supports clinical operations. "With EMC, our ability to replicate and recover data in the private cloud exceeds what is possible in the physical server world. We believe physical servers are higher risk because [the combination of EMC-driven storage consolidation and virtualized servers] provide better replicability and disaster recovery," explains Quinto.

The backbone of this state-of-the-art environment leverages EMC information infrastructure solutions. EMC RecoverPoint ensures high availability and business continuity for all virtualized applications by allowing data recovery at any point in time. AHRs uses EMC MirrorView to replicate data to two cloud-based data centers.

In addition to improved disaster recovery and business continuity, one of the primary benefits of the new model is streamlined application deployment and testing. In a traditional environment, it takes weeks to procure a physical server and attach it to the SAN for applications testing. Now, AHRs uses EMC SnapView software to streamline application testing, backup and recovery. The software snaps an image of a database at a point in time. After setting the snapshot onto a SAN, IT spins up a server and attaches it to an application to create a second environment for testing. The new process offers increased confidence with less staff time. It takes less than an hour to create the snapshot, and with a robust test environment staff can thoroughly identify problems and gaps.

### Stage is set for tier 1 clinical integration

University of Colorado Hospital (UCH) of Aurora, is in the middle of a massive re-engineering of patient data leading to a go-live of Epic EMR in February 2011. IT plays multiple critical roles in the project, but its primary goal cuts straight to the heart of healthcare. "We want to give clinicians and nurses the fastest system we can design," explains Lead System Architect Brent Starr. "We knew there would be issues with disparate applications communicating with each other and also with data duplication by disparate applications." UCH sought to design architecture on the back-end to support streamlined data flows among all departments; they wanted all providers, regardless of department, to access the same data rather than a copy of the data, which might be dissimilar or flawed.

In addition to patient care and IT issues, UCH also considered oth-

er factors. "As we designed the [EMR] architecture, we wanted to leverage our existing storage platform," explains CTO Joe Bajek. Since 2005, UCH had relied on EMC CLARiiON and Centera for PACS storage and enterprise backup. At the same time, with a three-year rollout, the hospital needed to consider the implications of rapidly changing technology. "We wanted to take advantage of emerging technology and implement the best solution out of the gate, but we also needed to complete a sound risk assessment in the process," says Bajek.

UCH also solicited input from partner hospitals that had already deployed an Epic EMR. After assessing its internal infrastructure and goals and surveying colleagues, UCH moved ahead with its



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plans and tasked EMC and other key vendors with designing an architecture to meet its requirements. An EMC team dedicated to Epic projects assisted with the design, tweaking architecture used in other implementations to meet UCH's specific goals. In September 2009, UCH deployed EMC Symmetrix VMAX with enterprise flash drive capabilities; the new system provides faster performance and greater scalability. It also helps set the stage for a vendor neutral PACS archive.

The UCH project is a work in progress; Bajek is confident of the process. Simultaneously bringing vendors to the table and charging them with working together to build the end solution lays the foundation for a better implementation, he says.

### Here comes the private cloud

As virtualization goes mainstream, another trend emerges: cloud computing.

Virtualization is a part of the journey to private cloud computing. The cloud computing journey is achieved after the third phase of the journey, when healthcare IT is offered as a service. **H&IT**

