

White paper

Confidence growing in cloud computing

Healthcare providers' challenges
and opportunities in digitalization

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Executive Summary

The amount of healthcare data that can reside in a cloud computing system continues to grow at an unprecedented rate. We are moving into an environment where data from scans, diagnostic and treatment methodologies, the number of patients going through a radiology department, tracer dosage levels, and more can and will be in the cloud, along with quick access to relevant information and links to thousands of medical journals. Some sources estimate that a single hospital generates 665 terabytes of data annually¹. That's the equivalent of watching Netflix's entire movie archive 45,000 times.

All this data presents challenges and opportunities on multiple fronts. Patient privacy continues to be a priority and a bigger challenge as data collection from mobile devices becomes more prevalent; patients are using smartphone-based applications to track their steps, their heart rate, sleep patterns, and other vital data, making them increasingly comfortable with their "numbers" being part of a larger dataset.

Speaking of smartphones and mobile devices, the use of tablets and smartphones will benefit healthcare entities as doctors and other staff are increasingly using mobile applications in their daily routines to collect patient data. Improvements in bandwidth can also help administrators see critical data in real time.

But "blue sky" talk is one thing. In reality, just how is all that data being managed and utilized to help a healthcare enterprise? Estimates by the Healthcare Information and Management Systems Society (HIMSS) are that 65 percent² of healthcare organizations worldwide are using cloud technology in some fashion. Healthcare enterprises that are not working in a cloud environment may miss significant advantages: enhanced user experiences, faster and more efficient scalability and predictable costs, faster system deployment, enhanced data security, potentially profound improvements in diagnosis and treatment by leveraging artificial intelligence and analytics, and the ability to use data to help remain in compliance with regulations. What are the full benefits and what may make more healthcare providers migrate to the cloud?

Introduction

Consider the diagnostic and therapeutic possibilities resulting from access to pertinent data from thousands of patient medical scans (without personal information identifying each patient). What new patterns, options, or evidence for actionable insights could be derived from all this information?

Cloud-based data is easily accessible via computer, smartphone, or tablet and is a valuable complement to the insights from the scores of articles published in medical journals each year – that’s about 2.5 million articles each year, according to estimates by the University of Ottawa³.

An environment like this is possible when digital innovation is made available and the healthcare team plays in the cloud.

“The purpose of a well-functioning healthcare system is to provide excellent care to its patients at the lowest cost possible. This is what value-based healthcare is all about,” says Johan Sjöberg*, a medical physicist at Karolinska University Hospital in Stockholm, Sweden.

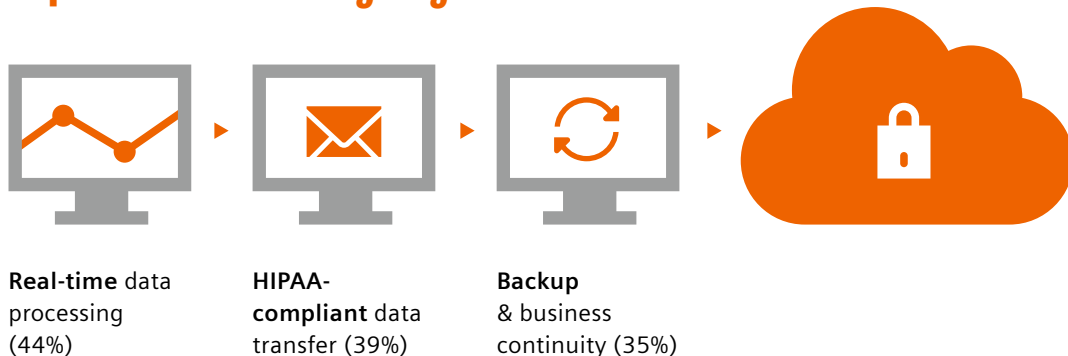
Unfortunately, many healthcare providers aren’t entirely there yet. “In healthcare we are dragging our tails [with cloud computing]. We’re a couple of decades behind the rest of society,” says Karolinska’s Johan Sjöberg. “I may quote the Minister of Health in Sweden,

who said that when you move into a healthcare sector and you look at how things are going, it’s like moving several decades back in time. We need to fix that.”

“We are in an environment where we have to provide more healthcare to more people using less resources,” says Ole Nygaard, Head of Digital for Nordics at Siemens Healthineers. “In the old days, everything was paper based. You had to manually pull out the data you need ... then hook up with the right people to discuss. We need to do things differently.”

There are three main task categories being migrated to the cloud, according to a recent HIMSS survey. Forty-four percent of respondents reported that they were using real-time data processing for clinical applications, while 39% were using the cloud for health information exchange, such as HIPAA-compliant transfer of health data between providers, government offices, and data clearinghouses, and 35% were using the cloud for backup and business continuity.

Top three tasks being migrated to the cloud:⁴



*Medical Physicist Johan Sjöberg (Medical Physicist) is employed by an institution engaged in contractual collaboration with Siemens Healthineers.

“What is a cloud? It’s just somebody else’s computer, right? There’s nothing magical about it,” says Karolinska’s Johan Sjöberg. “But there are a lot of benefits that are attributed to the concept of a cloud service. You have a central repository. It’s simple to build interfaces between the different layers in the databases. That offers the opportunity to roam the data and actually pull some interesting information from those databases, which is valuable to our patients in the end. It’s a shared platform. It offers a lot of opportunities, not just for data management, but also for communication management.”

Johan Sjöberg notes that the amount of data generated in healthcare today is “quadrupling every second year ... there is a lot of value in figuring out if there’s anything interesting [in that] health data.”

“A cloud environment breaks down the silo walls and enables a more holistic view on patient care,” says Thomas Friese, Head of Data Architecture and Digital Technologies for Siemens Healthineers. Friese notes that many leading-edge cloud solutions are forward looking in terms of the applications and benefits they can offer a healthcare enterprise. “The cloud offers a good opportunity to easily add on or migrate to new applications; it enables you to easily evolve.”

Continuously improving care

Cloud computing allows healthcare enterprises to utilize the latest technology at a fraction of the cost and deployment time of a local installation. For example, providers of cloud-based AI applications are highly scalable and can use a practically unlimited number of Graphical Processing Units (GPUs). Extensive studies have demonstrated that GPUs are more efficient for imaging processing applications than traditional Central Processing Units.⁵

A cloud environment easily unites healthcare professionals in a large-scale team effort, making the knowledge and insights of individual professionals available across a global network. Big data, already a burgeoning information resource for individual hospitals, becomes readily available, accessible, and easy to analyze since data sets located anywhere in the world are available to improve diagnostic capabilities, provide integrated decision support, and help physicians get a comprehensive view of a patient’s condition. Individualized treatment plans can increasingly be developed from valuable quantitative data. Enterprise-wide artificial intelligence-based assistants can serve as a clinical decision support mechanism (CDSM) for referring physicians ordering imaging tests. In fact, ClearData’s HIMSS Survey notes that the top three reasons for migrating to cloud computing are bolstering technological strength, cutting costs, and shortening the application development cycle.⁴

Top three reasons healthcare providers are using the cloud:⁴



Bolstering
technological strength



Reducing
costs



Shortening
the application
development cycle

Specific applications combining imaging and analysis are yielding promising benefits. For example, treatment planning for coronary artery disease patients can be improved through the use of quantitative data aggregated via the cloud. A comprehensive, noninvasive approach for patients with suspected coronary artery disease leverages imaging and insights on this condition and the impact that disease has on blood flow to the heart. Connected imaging tools can create a personalized three-dimensional model of a patient's arteries. A computer algorithm can then simulate blood flow and assess the impact of arterial blockages. This provides actionable information that helps physicians determine each patient's optimal course of treatment.

Siemens Healthineers' Friese points to situations in hospital trauma wards, where time is critical. An assessment for a stroke patient can be expedited with a centralized application and analysis capability as well as global access to medical experts.

Karolinska's Johan Sjöberg says, "We're moving into the big data domain. To work and orient yourself in big data, you need help from technology and artificial intelligence (AI) to find underlying trends and patterns. You're no longer limited to, say, 10 data points, which is manageable by one person. We're talking gigabytes and petabytes of data from many, many different and complex technological systems. And this is quadrupling every second year. Without technology it's not possible to do anything meaningful with all this data. We're moving into a domain where modalities and x-ray equipment and scanners are considered not as single machines, but more of an IT device in a large network ... an internet of things."

Networks of sites within a single healthcare provider can leverage cloud computing for accessing information from anywhere in the network. Data relevant to a particular case is consolidated and available from a single point of inquiry. Perhaps most important, the

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network may become a learning, evolving entity since the combined intelligence from clinics and clinicians is aggregated and made available network wide.

Day-to-day service improves via the cloud as well. "In my region, [healthcare providers] are legally obligated to provide an MRI within three months of someone getting a prescription, but the wait time [in some cases] was over one year," says Siemens Healthineers' Nygaard. He explained that a cloud-based solution, analyzing equipment usage across a network, helped alleviate this shortcoming.

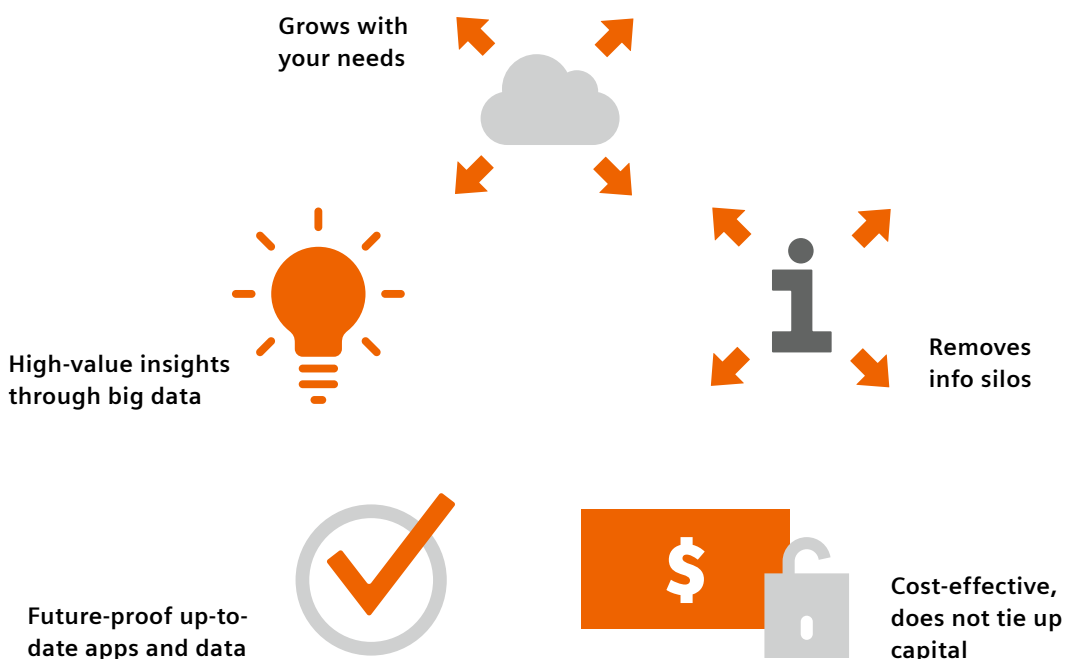
Managing the cost of care

Historically, there has been a lot of investment in the application side of digital health offerings, which in many cases rely on cloud aggregated healthcare data or generate health data themselves for the cloud.

The impacts and benefits of this investment are only beginning to be seen, as shown in the timeline below.

Healthcare expenditures in the United States comprise 25 percent of the Gross Domestic Product,⁶ and take up 12 percent in many European Countries⁷. These staggering numbers represent a clarion call for efficiency by healthcare providers. For their bottom line, being financially adept will lead to improved cashflow. For healthcare provider IT departments, financial considerations traditionally focused on the cost of so-called "digital estates" – a local server infrastructure, costs for staff, 24/7 availability, maintenance, back-up and recovery infrastructure, liability issues, and more. These are mostly fixed costs. In a cloud environment, a "pay-as-you-go" model allows for demand-oriented spending, which allows a healthcare enterprise to scale up or down at a predictable, manageable cost.

Added cloud services values



“We’re seeing a trend or focus that embraces subscription models or pay-as-you-go types of models, which help you predict and budget your potential costs for a particular solution going forward. [Healthcare enterprises] know when they budget on a year-to-year basis for their departments, the cost for that solution remains static. It’s something that becomes predictable going forward,” says Peter Shen, business manager for Siemens Healthineers in the United States.

It is important to keep in mind that on-premises applications require a lot of time and expertise to manage and maintain servers and applications. The individual enterprise is responsible for all security protocols, maintenance, end-user training, hiring and retaining the necessary IT staff, and more.

Cloud-based applications are more flexible, meaning less expensive to scale up as a healthcare enterprise grows. Deployment times are shorter, and the solution can scale up or down.

Siemens Healthineers’ Friese points out that healthcare enterprises are aware of what services cost from an IT standpoint (based on things like demand, usage patterns, or profile). Since the cloud environment creates a shared IT infrastructure, it therefore becomes easy to predict an enterprise-wide need and leverage the cost efficiencies of having an outsourced solution manage the systems and architecture.

Regulatory compliance

For any healthcare enterprise, compliance means more than just adhering to the law and internal company regulations; it is a permanent and integral part of who the healthcare provider is, how the business runs, and how members of that enterprise conduct themselves in their day-to-day jobs.

The operational regulatory-related considerations for a cloud environment include identifying who is accessing the data; setting the security protocols for the cloud environment so they meet the established protocols for the healthcare institution; understanding if there is a means to create greater efficiency with staff and workflows; establishing benchmarks to confirm and codify the possible applications of data in the cloud; and creating a plan to make use of that continuously growing trove of data.

Regulatory challenges can be more efficiently met with cloud computing. For example:

- Mandates on dosages stipulated through the EURATOM directive (a European regulation governing equipment using ionizing radiation). Standardized values or dose constraints can be consistently applied across a healthcare enterprise by following an enterprise-wide cloud computing application.
- Compliance and reimbursements governed by the Protecting Access to Medicare Act and the Medicare Access and CHIP Reauthorization Act (MACRA) in the United States.
- Cloud-based content management systems (CMS) can be leveraged to enable qualified clinical decision support mechanisms.

Accessing enterprise-wide statistics on equipment usage and lab operations from any location and with any view (one or more institutions, labs, or departments within a healthcare enterprise, for example) requires a system-wide solution.

This helps healthcare professionals identify areas needing improvement or areas where success could be replicated elsewhere within the enterprise. A robust cloud environment provides consistent metrics for conducting analyses and identifying best practices that ultimately lead to a high quality of care.

The European General Data Protection Regulation (GDPR) is affecting healthcare providers on both sides of the Atlantic Ocean. Under GDPR, offering paragraphs or multiple pages of fine print with a request to “click here to agree” will not suffice to protect a patient’s privacy. New requirements for understanding and agreement of data use and privacy are driving the industry’s appetite for a digital solution.

Siemens Healthineers’ Friese also notes that designers of cloud solutions have privacy benchmarks such as GDPR ingrained into their thinking. He says healthcare enterprises can realize enhanced security via the cloud. “By sharing the infrastructure and the resources that [are involved with] security in no way compares to what any isolated institution can do.”

Patient privacy is what every healthcare professional lives and breathes. Patient privacy’s importance looms even larger when the conversation turns to putting terabytes of data in a cloud. Data in a healthcare cloud environment needs protection on two fronts: the gateway (how data is moved throughout the enterprise, be it on workstations or mobile devices) and the archiving infrastructure.

“When it comes to healthcare, there are frequent concerns about what type of data is actually stored in the cloud,” says Siemens Healthineers’ Nygaard. He says that “de-identifying” the information stored in the cloud is becoming a top priority for

healthcare enterprises and for cloud providers. “For instance, for a radiation dose structure report, the cloud concept is that there is an estimation based on the height and weight of the patient. Sometimes it is a matter of maintaining a balance between de-identification and the usefulness of data,” he explains.

Privacy issues are compounded with the pervasive use of mobile devices. Consistent data security with respect to the use of various information access platforms – phones, tablets, computers – is now a paramount item on the IT “to-do” list. Good healthcare cloud solutions provide options for different levels of security and data protection, including the de-identification or anonymization of patient information, all customizable based on the privacy demands of individual countries.

Healthcare enterprises should seek out a strong security partner that deploys cutting-edge security (encryption, segregation, and destruction safeguards for all information), who adds security measures, protects your web access, and limits access to only those with proper authorization. Strictly controlling access further protects sensitive information while providing authorized personnel full control over data – making it as granular (or not) as needed.

Established providers of cloud security – Microsoft, Google, Amazon – all devote huge resources to security because their reputation is based on this. Additionally, cloud service providers have adapted to HIPAA regulations and have made HIPAA compliance an integral part of their business. HealthITSecurity.com reports⁸ that “cloud computing has been around for some time, and it is not a new notion for data to be stored on remote servers.”

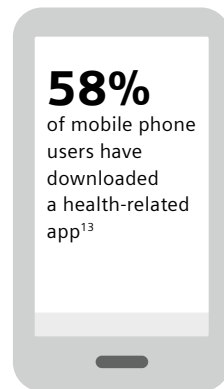
The mindset for privacy is changing on the patient side, too. Nearly 40 million adults in the United States are wearing personal data devices (digital step measurements, smart-watches, or other devices), creating a mindset of sharing data over a network. Nearly one in six individuals has used a mobile phone to download a health-related mobile app; witness the fact that there are nearly 800 applications for monitoring diabetes for either Android or Apple smartphones.⁹ And Pricewaterhouse Coopers estimates that 65 percent of patients say they are excited about using a wearable device from their doctor's office.¹⁰

"Everything that you're so accustomed to in your private life is going to take over in the healthcare space," explains Siemens Healthineers' Nygaard. "For instance, you don't need to own things. You can purchase the rights to use them only when needed. Fewer people are buying CDs or DVDs. We may soon not even own a car, but rather be part of a fleet of self-driving vehicles. This change is largely based on the availability of cloud services. A similar development is happening in healthcare."

39.5
million U.S. adults
are using wearable
devices¹¹



65%
of patients would
be excited about
using a wearable
device from their
doctor's office¹⁰



58%
of mobile phone
users have
downloaded
a health-related
app¹³

iOS Android
390 380

Diabetes apps available⁹



“We are interested in becoming better in efficiency, effectiveness, timeliness of care, accessibility to care, and patient safety. Implementing a cloud-based computing environment in healthcare is a natural progression for any provider who aspires to improve in those areas.”

Johan Sjöberg, Medical Physicist, Karolinska University Hospital, Stockholm, Sweden

Points covered

- The cloud unlocks the potential of all that medical data being generated, thereby making advancements in diagnosis and treatment possible.
- Cloud computing can help bring healthcare enterprises into compliance with many regulations, making them more efficient and better able to focus on their mission.
- Clinical applications are increasingly being designed for the cloud.
- Costs are more predictable via a cloud-based IT infrastructure.
- Patients are becoming comfortable with the idea that their personal data will be in the cloud.
- Privacy and, by extension, data protection play a very special role in healthcare and should be handled by trustworthy service providers.

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