

## Healthcare Systems Needs Cloud Transformation Reform

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### ABSTRACT

The journey of computing history is fascinating, beginning with mainframes and evolving through personal and network computing, with a notable shift towards distributed computing in the late 20th century. This progression set the stage for a revolutionary leap with the advent of cloud computing, fueled by the burgeoning use of the internet and its infrastructure. As cloud computing gradually permeated the market, it has become a dominant force, projected to reach a staggering \$25 billion global industry by 2028, showcasing its significant impact and widespread adoption. Today's IT vision across industries prominently features cloud migration, with healthcare notably positioned to leverage cloud advancements despite facing data security concerns. The progression of cloud technology, potentially augmented by blockchain, promises to address these security challenges. A crucial benefit for healthcare in the cloud is enhanced interoperability. Reflecting on reforms like those incentivizing Electronic Health Records (EHR) use, a similar push is needed to transition healthcare information systems to the cloud on a national scale. This article delves into innovative approaches and examines how such a transformation could herald a new era in healthcare, significantly reshaping the industry

**Keywords:** Healthcare; Healthcare Reform; Medicaid; Medicare; Healthcare Challenges; Cloud Computing

### Introduction

The fragmented nature of the healthcare system, especially evident in countries like the United States, leads to inefficiencies and complexities in patient care coordination. This fragmentation arises from a diverse array of healthcare providers, payers, and regulatory bodies operating without a unified system, often resulting in redundant care, increased costs, and gaps in health information exchange. Patients frequently navigate between multiple specialists and healthcare facilities, facing challenges in maintaining a coherent medical history and receiving consistent advice. The lack of a centralized healthcare database exacerbates these issues, hindering the seamless flow of patient information. This disjointed structure not only affects the quality of care but also places a significant administrative burden on healthcare providers, detracting from their primary focus on patient health

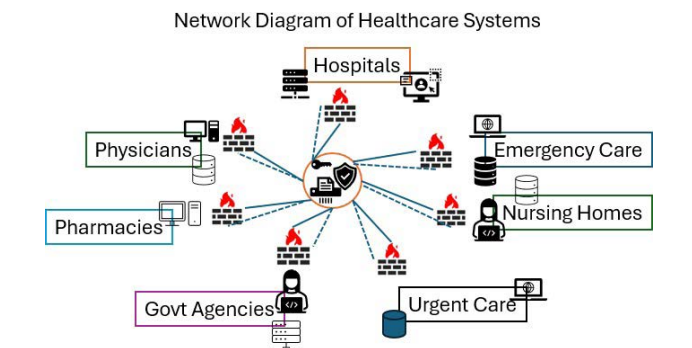
The fragmented nature of healthcare systems is primarily due to historical, regulatory, and economic factors. Historically, healthcare systems evolved independently within different regions and sectors, leading to a lack of standardization in processes and technologies. Regulatory frameworks vary significantly by country and even within regions of the same country, complicating efforts to create a unified system. Economically, the interests of various stakeholders, including insurance companies, healthcare providers, and pharmaceutical companies, often conflict, hindering collaboration and integration. Furthermore, the rapid pace of technological advancement has outstripped the ability of regulatory bodies and healthcare organizations to adapt, exacerbating fragmentation. Lastly, there is often a significant gap in the adoption of digital health technologies and data-sharing protocols, which are crucial for creating a cohesive healthcare ecosystem.

Efforts to streamline the healthcare supply chain have been persistent, with significant initiatives undertaken by healthcare think tanks and policymakers aimed at enhancing system efficiency and patient care quality. One notable example of these efforts is the Obama Administration’s healthcare reform, which sought to address several systemic issues. A key component of this reform was the promotion of Meaningful Use (MU) standards, which incentivized the adoption of Electronic Health Records (EHRs), propelling healthcare entities toward a digital framework. This move was instrumental in laying the groundwork for a more interconnected healthcare system, enabling different healthcare providers and organizations to begin sharing digital health information more seamlessly.

However, despite these strides towards integration, the healthcare system remains notably fragmented. While EHRs facilitated a shift towards digital collaboration, the implementation and standardization across different entities have been inconsistent, leading to partial silos where information exchange is still cumbersome. The barriers to full interoperability and data sharing are multifaceted, including technical limitations, privacy concerns, varying standards across states and organizations, and the significant costs associated with upgrading legacy systems. The healthcare reform and the push towards MU were crucial steps in the right direction, yet they addressed only a portion of the broader challenge of healthcare fragmentation. Today’s healthcare landscape is characterized by a patchwork of systems and protocols, with patients often navigating complex networks of providers and services that may not effectively communicate with one another.

**Well, begun is Half Done**

The digitization of healthcare information has significantly advanced, with an extensive range of healthcare providers and facilities-encompassing hospitals, physician offices, pharmacies, ancillary services, urgent care centers, and emergency units-adopting digital platforms. These systems are adept at storing, retrieving, and transmitting medical records, marking a pivotal shift towards a more integrated approach to healthcare management. Despite this progress, a critical challenge persists in the inherent diversity and complexity of these digital systems. Although they are built on common principles aimed at facilitating seamless data exchange, the unique development and configuration of each system introduce significant barriers to interoperability (Figure 1).



**Figure 1:** Simplified network diagram of healthcare systems. Showing each system has to pass through another system firewall.

What is required to talk to two systems effectively?

1. The systems should have the capability to communicate.
2. They both should have a common medium to understand each other’s communication, act, and respond.

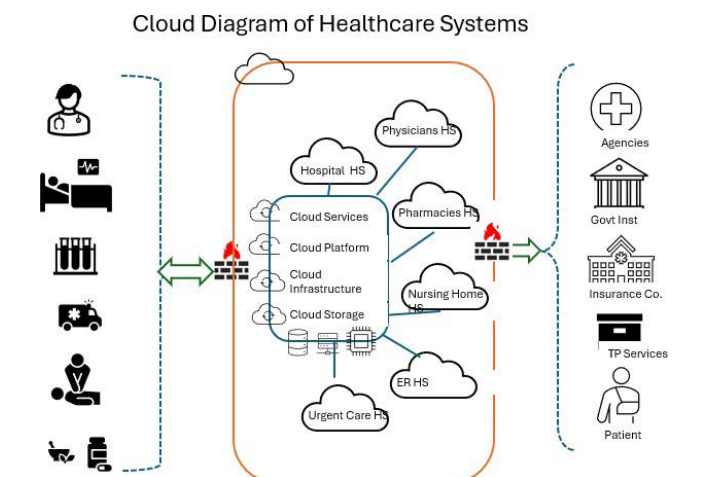
The issue of interoperability is exacerbated by the geographic dispersion of these systems, each subject to a distinct set of security protocols and compliance standards tailored to meet local and federal regulations. This variability necessitates that for any two systems to communicate, they must navigate a complex web of security measures, a process that can be both time-consuming and resource intensive. As a result, the efficiency of data transmission and the frequency of interaction between systems are compromised. In some instances, these challenges can lead to reduced effectiveness in communication or, in the worst-case scenarios, complete failure to exchange crucial health information

Moreover, the need for systems to consistently cross these barriers for every interaction places a significant strain on healthcare IT infrastructure, potentially leading to delays in care delivery, increased risk of data breaches, and higher operational costs. This situation underscores the critical need for a more standardized, unified approach to healthcare data management and exchange.

To address these challenges, the healthcare industry must prioritize the development of interoperable systems that can seamlessly connect with one another, regardless of geographical location or the specific security measures in place. Solutions such as the adoption of universal data exchange standards, the implementation of more adaptable security protocols, and the integration of cloud-based platforms could significantly mitigate these barriers. Cloud computing, in particular, offers a promising pathway towards achieving this goal, providing a scalable and secure environment for data exchange that transcends local constraints and facilitates real-time, effective communication between disparate healthcare systems

**Transitioning to The Cloud Platform**

The success of transitioning healthcare systems to the cloud hinges significantly on the collective migration of related healthcare entities within a specific geographical region. By moving to cloud-based platforms, these systems can achieve faster connectivity and more efficient intercommunication, fundamentally transforming the way healthcare services are delivered and coordinated. To ensure the effectiveness of this transition, it is imperative that a comprehensive program is developed, one that delineates the standards, protocols, and best practices for cloud migration (figure 2).



**Figure 2:** Simplified cloud diagram of healthcare systems. Showing efficient interconnectivity between the various healthcare systems

For instance, consider the healthcare ecosystem within the Boston area. If every healthcare facility—from hospital to clinics, pharmacies to emergency services—were to adopt a unified approach to cloud migration, employing standardized protocols and practices, the benefits would be manifold. Such a coordinated effort would facilitate common access routes and interoperability standards, streamlining the transition process and enhancing the overall efficiency of data exchange and communication. This not only saves time during the transition period but also maximizes the output and utility of the healthcare systems post-migration. However, the foundation of this innovative transition rests on the willingness and active participation of the healthcare organizations involved. It requires a strong commitment from each entity to invest in the necessary resources and to embrace the changes that come with cloud migration. This willingness must be underpinned by a clear understanding of the long-term benefits of such a transition, including improved patient care, enhanced data security, and operational efficiencies.

The adoption of cloud technology in the healthcare sector offers a revolutionary approach to overcoming traditional barriers to data exchange and communication.

By leveraging the cloud as a technological backbone, healthcare systems can establish a common, trusted gateway for access. This approach effectively navigates firewall barriers, streamlining access requests to facilitate faster yet secure communication between different entities within the healthcare ecosystem. This unified gateway not only simplifies connectivity but also enhances the security framework, ensuring that sensitive health information is safeguarded against unauthorized access and cyber threats.

The implementation of standardized intercommunication protocols, such as Application Programming Interfaces (APIs), Health Level 7 (HL7), and Fast Healthcare Interoperability Resources (FHIR), plays a crucial role in the seamless exchange of information between cloud-migrated systems. These standards are specifically designed to address the complexities of healthcare data, promoting interoperability and enabling the efficient, secure transfer of electronic health records (EHRs) and other critical healthcare data across different platforms and systems.

Rest all the cloud standard security, and implementation practices will ensure the compliance and overall completeness of the transition.

The integration of APIs allows for flexible, real-time communication between applications, facilitating immediate access to patient data when and where it's needed, thus improving the quality and speed of patient care. HL7, a set of international standards for the transfer of clinical and administrative data between software applications used by various healthcare providers, ensures that data exchanged between systems can be interpreted correctly. Meanwhile, FHIR builds on the strengths of HL7, offering a more modern, web-based approach to healthcare information exchange, supporting a wide range of applications, including mobile apps, biometric devices, cloud communications, and data analysis tools, thereby further enhancing data accessibility and interoperability.

By establishing a cloud-based, common trusted gateway and adopting these intercommunication standards, healthcare systems can achieve a level of connectivity and data exchange that was previously unattainable. This transformation not only

accelerates the delivery of healthcare services but also strengthens the security measures protecting patient information. The move towards such an integrated and standardized infrastructure is imperative for the evolution of healthcare delivery, paving the way for more coordinated, efficient, and patient-centric care.

In essence, the strategic implementation of cloud technology and interoperability standards heralds a new era in healthcare, where data fluidity and security coexist, empowering healthcare providers to deliver the highest levels of patient care.

### Few Things to Consider

Indeed, while cloud computing presents a promising avenue for addressing numerous challenges within the healthcare sector, it is not without its limitations and risks. The potential of cloud technology to revolutionize healthcare is balanced by certain constraints that require careful consideration and strategic planning to mitigate.

**Dependency on Cloud Service Providers:** The transition to cloud-based systems places healthcare organizations in a position of reliance on their chosen cloud service providers. This dependency can become particularly challenging if there arises a need to switch providers, whether due to service issues, cost considerations, or a change in regulatory requirements. Transitioning between cloud services is not only operationally complex, involving the migration of vast amounts of sensitive data, but it can also prove to be a costly and time-consuming process. To address this, healthcare organizations must conduct thorough due diligence when selecting a cloud provider, ensuring flexibility, scalability, and a clear understanding of the migration process and costs involved.

**Data Security Concerns:** Although cloud providers often implement robust security measures, apprehensions regarding the security of patient data in the cloud continue to persist. The potential for data breaches and unauthorized access remains a significant concern, given the sensitivity of health information. To counteract these risks, healthcare organizations must demand and participate in establishing stringent security protocols, including end-to-end encryption, regular security audits, and compliance with healthcare regulations such as HIPAA in the United States. Additionally, selecting cloud providers that offer dedicated healthcare solutions with a strong track record of security and compliance can further mitigate these concerns.

**Internet Dependency:** The inherent nature of cloud services means they are accessed primarily through the Internet. This creates a vulnerability in scenarios where internet connectivity is unreliable or unavailable, particularly during emergencies when access to patient records and critical healthcare applications is most crucial. Healthcare organizations must therefore implement contingency plans to address potential internet outages. Solutions may include maintaining on-premise backups of critical data, using hybrid cloud models that offer offline access to essential functions, and ensuring that there are redundant internet service providers and failover systems in place.

### Conclusion

In conclusion, while significant efforts like the Obama Healthcare Reform have laid the groundwork for a more integrated healthcare system, overcoming the entrenched fragmentation requires ongoing innovation and adoption of new technologies. Cloud computing holds the potential to address these challenges comprehensively, moving the healthcare system towards a more

unified and patient-centric model. While the widespread adoption of digital platforms in healthcare represents a significant step forward, achieving true interoperability remains a formidable challenge. Overcoming this will require concerted effort across the healthcare ecosystem to embrace innovative solutions and collaborative approaches that ensure a secure, efficient, and uninterrupted flow of health information, ultimately enhancing patient care and system efficiency.

Cloud computing emerges as a promising solution to these enduring challenges. By leveraging cloud technologies, healthcare organizations can achieve greater scalability, flexibility, and interoperability. Cloud platforms can facilitate the seamless exchange of health information across diverse healthcare ecosystems, breaking down the silos that have traditionally hindered collaboration and data sharing. This transformation can lead to more coordinated care, improved patient outcomes, and enhanced operational efficiencies.

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