

## Overcoming IO Saturation in Healthcare IT: Strategies for EPIC System Optimization

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### ABSTRACT

In today's healthcare industry incorporating Information Technology (IT) is crucial, for ensuring operations and high quality patient care. The growing reliance on Electronic Health Records (EHRs) and digital tools has led to an increased need for IT infrastructure in storage systems. This document outlines a study on how EPIC workload executions impact storage systems focusing on the challenges of Input/Output (IO) saturation and its implications for healthcare services. EPIC Systems, an EHR provider, is at the center of this research underscoring the importance of effective and resilient IT environments in healthcare. The study highlights the use of Converged Infrastructure (CI) deployments to support Epic EHR systems as an approach to improving data management, scalability, security and compliance in healthcare settings. By combining literature reviews with hands on testing using FlexPod Datacenter infrastructure and leveraging the GenIO tool this study demonstrates the advantages of integrating EPIC with CI solutions like enhanced healthcare services delivery increased data protection and adherence, to industry standards.

**Keywords:** Healthcare Information Technology (IT), Electronic Health Records (EHR), EPIC Systems, Converged Infrastructure (CI)

### 1. Introduction

In the evolving healthcare field having an Information Technology (IT) foundation is essential, for running smooth operations and delivering top notch patient care. Robust IT solutions play a role in managing the amount of sensitive healthcare data securely and effectively. However, setting up and managing these IT systems comes with its share of challenges. These challenges include ensuring data privacy and security, integrating systems controlling costs associated with cutting edge technology and maintaining system reliability and uptime.

A key aspect of healthcare IT infrastructure is ensuring that storage systems perform well and can scale as needed. As healthcare professionals increasingly rely on Electronic Health Records (EHRs) and other digital tools there is a growing demand for storage capacity that can handle the workload without getting overwhelmed. When a storage system becomes saturated with

Input/Output (IO) it means it has reached its limit, in processing requests. This could lead to delays that might impact patient care quality and operational effectiveness.

This article delves into a case study that uses the EPIC workload execution to showcase how IO saturation affects the storage system. EPIC Systems, a known provider of Electronic Health Record (EHR) and healthcare software is widely used in hospitals and healthcare facilities. The study aims to highlight the impact of high demand workloads, like EPIC on storage systems and stresses the importance of enhancing infrastructure to handle demanding requirements. It explores the balance between performance and operational efficiency in maintaining a reliable healthcare IT infrastructure by operating within a latency threshold.

The focus of this study is not on recognizing the challenges and consequences of IO saturation in healthcare IT environments.

Also on proposing solutions to mitigate these issues. The research aims to offer insights, into designing and managing IT infrastructures that can meet the needs of the healthcare sector by thoroughly analyzing how the EPIC workload affects storage systems. The project intends to address these challenges head on to establish resilient, efficient and scalable healthcare IT ecosystems.

## 2. Converged Infrastructure (CI) Deployments to Support Epic Electronic Health Record (EHR)

Implementing convergent infrastructure (CI) to support Epic Electronic Health Record (EHR) systems provides healthcare companies with an opportunity to enhance efficiency, scalability and data management capabilities. However the complexity of these connections requires planning and execution.

Here are some suggestions, for healthcare organizations starting on this path.

### 4.1 Conduct Needs and Assessment

Conduct a comprehensive assessment of needs. Begin by evaluating your organization's IT infrastructure specifically identifying any shortcomings or limitations that could impede the integration of a converged architecture. Understanding the requirements related to storage, computing power and networking for the CI deployment is crucial, to meeting the needs of the Epic EHR system.

### 2.2 Prioritize Scalability and Flexibility

Make sure to prioritize scalability and flexibility when choosing a CI system. It's important to select a system that not only meets your needs but also has the ability to grow with your business in the future. This includes being able to add storage, computing power and networking features as your business and data requirements evolve. Long term success depends on being able to integrate with existing systems and adapt well to technologies.

### 2.3 Ensure High Availability and Disaster Recovery

Another key aspect is ensuring availability and disaster recovery, for EHR systems, in healthcare settings. It's crucial to choose a CI platform that can handle failovers effectively and minimize downtime. Developing disaster recovery plans that include data backups and quick restoration procedures in case of emergencies will help maintain the integrity and accessibility of data.

### 2.4 Emphasize Security and Compliance:

It's crucial to focus on security as a priority. Make sure that the CI solution you choose complies with healthcare regulations like HIPAA in the US and other local data protection laws. Implement security measures such as encryption, access controls and network security protocols to protect patient information from unauthorized access and cyber threats.

### 2.5 Engage in Vendor Collaboration

Foster collaboration with vendors. Work with vendors who have a proven track record in implementing Continuous Integration (CI) in healthcare environments, those experienced with Epic Electronic Health Record (EHR) systems. Their expertise is key to ensuring an effective implementation process. Consider vendors that offer support and training services to facilitate a transition, for your IT team and end users.

## 2.6 Focus on Staff Training and Change Management

Emphasizing the Importance of Employee Training and Change Management implementation of Continuous Integration (CI) hinges on gaining the support and buy in of all team members involved in the project. Develop a change management plan to effectively address any resistance and ensure a grasp of the advantages and functionalities of the new system. Dedicate resources to training initiatives for both IT staff and end users. This approach helps in overcoming resistance to change. Also ensures that the organization can fully harness the capabilities offered by the Epic EHR system through CI.

## 2.7 Monitor Performance and Continuously Optimize

Monitor performance closely and continuously. Once CI deployments in place it is crucial to assess its performance to guarantee that it meets the requirements of the Epic EHR system effectively. Be prepared to adjust and enhance your infrastructure as needed in response to evolving demands and technological advancements thereby maintaining efficiency and delivering patient care. Healthcare institutions can establish scalable and dependable IT operations that bolster high quality patient care by adhering to these recommendations, which will assist them in navigating the complexities associated with implementing integrated infrastructure solutions, for Epic EHR systems.

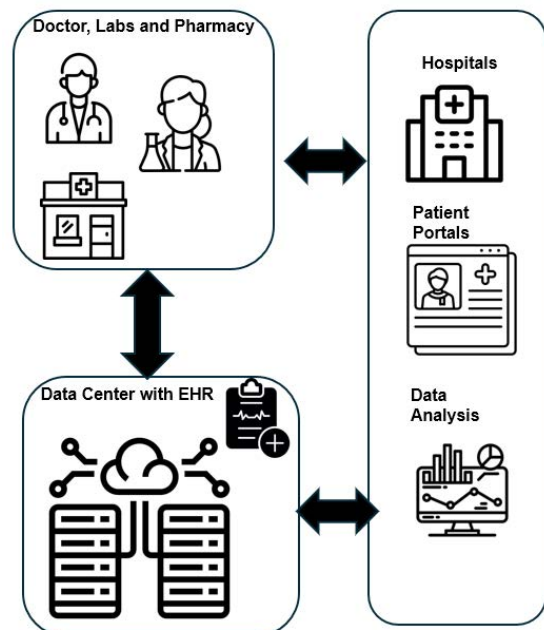


Figure 1: Healthcare IT setup with Data Center

## 3. Literature Review

The healthcare sector is seeing changes, in how information technology (IT)'s utilized focusing on making decisions<sup>1</sup>. The research article highlights the increasing importance of IT in the U.S. Healthcare industry marked by investments and expected growth in IT applications within the field. Key discoveries include addressing communication needs detailing a day for Robert and showcasing the Internet of Things protocol stack for healthcare settings. The Internet of Things is seen as a facilitator for healthcare applications<sup>2</sup>.

IT plays a role in reshaping healthcare management practices<sup>3</sup>. Healthcare management is evolving due to advances in information technology. Artificial intelligence and robotics are now integrated into healthcare practices while virtual reality aids in training. The use of Hospital Management Information

Systems (HMIS) is essential for data handling. Moreover leveraging data analytics is critical, for managing healthcare data. Safeguarding medical data privacy and security remains a priority.

The significance of information technology (IT), in the healthcare sector is showcased through the development of an Android based app for patient monitoring leveraging the Internet of Things (IoT) and cloud computing technologies<sup>4</sup>. Research on building apps using cloud computing tools is limited. Emphasizing system and software design is crucial for IoT and cloud based healthcare applications. The architectural model proposed in the study can be applied across healthcare fields.

Moreover the necessity of a process oriented IT framework for interconnected healthcare systems is underscored<sup>5</sup>. Healthcare information systems play a role in improving healthcare standards. A healthcare information system should have a design to adapt to changing needs. Key factors in designing a healthcare information system include flexibility, adaptability, robustness, integration with existing systems, compliance, with standards, semantic compatibility, security measures and process orientation.

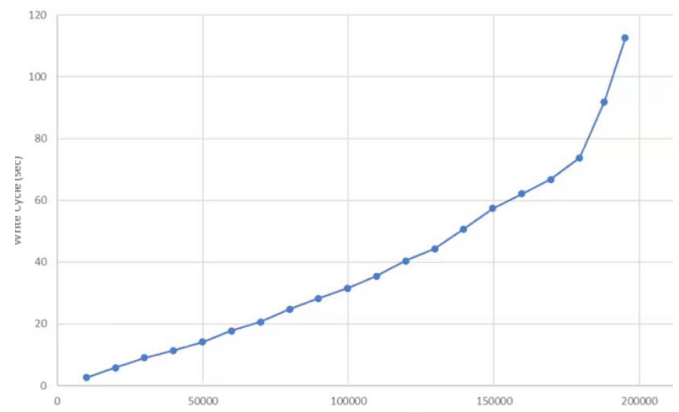
#### 4. Results

In order to implement Epic Electronic Health Records (EHR) we decided to use the FlexPod Datacenter infrastructure in our study. The FlexPod Datacenter solution is a proven approach, for incorporating Cisco and NetApp technologies and solutions to create a shared public cloud setup. We conducted tests to assess the feasibility of a facility serving as an EPIC client hosting EPIC on their premises with the help of the FlexPod Datacenter. Furthermore we looked into the possibility of extending this setup into a cloud enabling the facility to provide EPIC as a service to its clients.

Our study revealed that the FlexPod Datacenter infrastructure offered the required scalability and performance for hosting EPIC in an environment. Deploying EPIC on a cloud through FlexPod Datacenter could potentially streamline operations. Enhance patient care outcomes. This approach would also make it easier for the medical facility to adjust their services as necessary and potentially cut down on costs associated with managing their infrastructure. In general combining EPIC with FlexPod Datacenter presents a solution for improving healthcare delivery. Additionally integrating EPIC with FlexPod Datacenter could strengthen data security measures. Ensure compliance with industry regulations. This could ultimately boost confidence, in the facilities ability to safeguard their confidential information.

The GenIO tool, also known as GenerationIO is used to validate this solution. Its purpose was to run the workload on a machine to show the saturation of input/output operations, on the storage while keeping system performance within a latency limit. A single virtual machine (VM) was used to generate the workload ensuring that IO performance on the storage controllers was not impacted by any restrictions in CPU cores or RAM.

Epic customers are leveraging VMware for deploying their healthcare applications as part of their infrastructure upgrade thereby modernizing their data center. The data presented demonstrates that clients can run their Epic workload alongside Clarity and VDI desktops for running workloads, on a shared infrastructure.



**Figure 2:** IO saturation of storage with write cycles

#### 5. Conclusion

This research emphasizes the importance of having IT systems, in the healthcare industry specifically looking at the issues and solutions related to supporting Epic EHR systems. The study shows that using Converged Infrastructure, such as FlexPod Datacenter offers a way to handle EPIC workloads effectively ensuring scalability, performance and security. It stresses the need for planning, prioritizing scalability ensuring availability focusing on security collaborating with vendors investing in staff training and consistently monitoring performance as essential strategies for successful CI deployment. By following these approaches healthcare institutions can enhance their IT setup to boost efficiency improve patient care quality and meet requirements. The partnership with teams from Cisco and NetApp has played a role, in offering valuable insights and supporting the smooth implementation of these solutions.

#### 6. Acknowledgements

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