



Performance Testing for Cloud Base Healthcare Systems

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Introduction

The extremely rapid increase in the growth of cloud computing has transformed the approach the users access and store digital information. As enterprises increasingly rely on cloud-based services and data storage, demand for strong and scalable infrastructure to support these services has to attain unprecedented levels. The tremendous increase in the cloud computing implies the necessity of providing a efficient resource allocation, improved user experience, maintaining reliable and scalable environments.

As the pandemic has put the necessity for moving the health care to Cloud computing, as most of employees started to work remotely the lack of cloud infrastructure made it more difficult to collaborate in the hybrid environment. Jim Fitzgerald, Cloud Wave says "Adapt is a simple term with a lot of technical depth behind it. Efficient and crisp adoption of cloud IaaS/Platform/SaaS models in healthcare require adaptation from both the cloud service provider and the healthcare organization. The Cloud Service providers should provision a compute, storage, networking, platform and security infrastructure models that fits the Healthcare industry needs.

Robinson said. "Healthcare IT is security focused, but the security risk to an organization is more heightened from a lost device or stolen password than it is a cloud breach of patient information." Trusting external cloud experts – who specialize, research and invest in developing a capable and secure cloud will remove a lot of the burden of building and securing entire environments from the healthcare organization, allowing them to focus on patient care and needs.

Performance testing reduces the risks of building cloud-native apps, safeguarding end users from cloud computing pipeline complications and preventing downtime and cost benefits.

What is a cloud Infrastructure

Cloud Infrastructure refers to a network of servers, Databases that can be accessed for storing, processing, managing data, network and software remotely through an internet.

A cloud server is a virtual server that operates in a cloud computing environment and makes its resources accessible to users remotely over a network. Cloud-based servers are intended to provide the same functions, support the same operating systems and applications and offer similar performance characteristics as traditional physical and virtual servers that run in a local data center.

Types of Cloud Services for Health Care

Software as a Service (SaaS)

Software as a Service (SaaS): SaaS provides a complete product that is run and managed by the Cloud service Provider. This includes applications like Electronic Health Records (EHR) systems and telemedicine platforms that are accessed via the internet. Platform as a Service (PaaS): Provides a platform allowing healthcare organizations to develop, run, and manage applications without dealing with the underlying infrastructure. Infrastructure as a Service (IaaS): It Provides access to networking features, computers and data storage space. Offers virtualized computing resources over the internet.

How do cloud Servers Work?

Cloud servers work by virtualizing physical servers to make them accessible to users from remote locations. The compute resources of the physical servers are then used to create and power virtual servers, which are also known as cloud servers. These virtual servers can then be accessed by organizations through a working internet connection from any physical location and resources are allocated to users on a need basis. Cloud servers are provisioned and managed through cloud-based application programming interfaces (APIs). Cloud service providers maintain network of physical servers in data centers worldwide. The consumers of clouds infrastructure can specify the amount of CPU, memory, storage and other resources required and can be charged based on the usage.

Cloud computing in healthcare makes medical record-sharing easier and safer, automates backend operations and even facilitates the creation and maintenance of telehealth apps.

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Utilizing the cloud increases the efficiency of the healthcare industry, while also decreasing costs.

Benefits of cloud Computing

Many enterprises are switching to Cloud and realizing some of these key benefits as a result:

- **Real-time collaboration:** The cloud makes real-time updates for data platforms and other applications possible, which makes accurate and flexible collaboration possible for all users.
- **Scalable features:** Cloud systems are fluid enough to scale to a company's needs. With a pay-as-you-go model for storage, security, and other cloud-based services, businesses can easily scale forward or backward as their requirement change.
- **Remote and mobile access:** A cloud setup makes remote and mobile access possible, expanding where employees can work and where companies can hire.
- **Security monitoring and automation:** Cloud providers typically double as cybersecurity providers, with automation and constant monitoring built into their systems.
- **Disaster recovery and data management:** The cloud saves the latest version of data and application updates, and it makes it easy to create backups. This setup not only improves data quality and data management capabilities, but also makes it easier to recover data in the case of a security breach.

Benefits of Cloud Computing in Healthcare

- Accelerates clinical analyses and care processes.
- Automates data processing and scalability.
- Increases patient data accessibility.
- Reduces network equipment and staff costs.
- Reduces risk of data loss.

Pfizer has selected Oracle Health Sciences InForm Cloud Service and Siebel Clinical Trial Management System Cloud Service to help simplify how it manages both operational and study data, for in-house as well as outsourced trials, says Rob Goodwin, Pfizer vice president of global product development.

Importance of cloud Performance Testing

Cloud performance testing helps to ensure your cloud-based applications are functioning as expected. It directly influences their success by optimizing resource utilization, improving user experience, and maintaining reliability and scalability, especially during peak usage and cost effective.

- **Effective Resource Allocation:** Cloud performance testing maximizes resource efficiency by identifying and addressing performance issues, leading to cost-effectiveness and overall system improvement.
- **Personalized Application Testing:** Leveraging cloud systems for testing enables organizations to replicate customer-centric environments, helping you explore various test scenarios, configurations, and environments. This flexibility saves both time and costs associated with procuring diverse testing infrastructure.

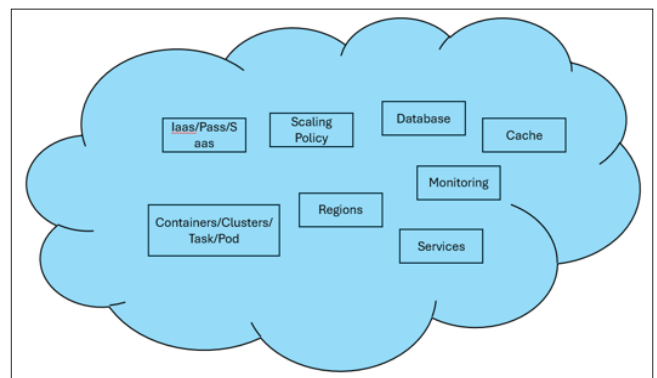
- **Enhanced User Experience:** Cloud performance testing supports user retention, ensuring swift response times and consistent application behavior.
- **Consistency and Scalability Assurance:** Testing allows developers to record application behavior under varying loads and conditions, ensuring functionality and scalability amidst changing demands. Failover testing allows to ensure the environment capacity when there is a disaster
- **Benchmarking and SLA Compliance:** Verifying that applications meet performance benchmarks and service level agreements is crucial, particularly during cloud migrations from on-premises to cloud environments. Performance Testing helps to verifying the scaling policy, algorithms on the load balancing which will enhance the performance of the application.
- **Cost Efficacy:** As the Cloud Infrastructure cost is calculated based on the usage of the servers and pods. Performance Testing helps to optimize the usage of the CPU, Memory and the algorithm on the resource allocation based on the auto scaling policy. Performance endurance testing helps to find any memory leaks happening at the servers at the performance tuning will be helping to fix the issues before going to the production

Cloud Performance Testing Strategy

- Distinguishing Cloud Infrastructure
- Test Scenarios
- Auto Scaling Policy
- Load, Endurance, Failover Testing
- Monitoring

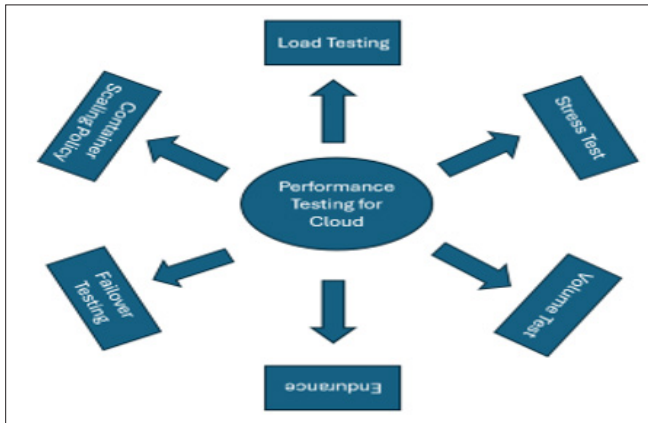
Distinguishing Cloud Infrastructure

From a performance testing perspective, we have to understand the Cloud Infrastructure the techniques and Terms for the better and quality deliverables.



Test Scenarios

Understanding the account, the region the services hosted, virtual server capacity, the scaling policy under the % of utilization and the min max count also understand the Garbage allocation policy and the heap. We must perform the testing to evaluate the performance for the availability, scalability and Reliability of the application and come up with the scenarios to achieve the availability, Scalability and Reliability be performing Load testing, Endurance, Stress and Failover



Auto Scaling Policy

Understand the scaling policy and what is the min and max count (1 to 4) for auto scaling and the utilization point when the scaling will be applied like 70% or 80%. The scaling policy is applied in CPU or Memory. Perform the Endurance Test for long duration and analyze the behavior of the containers and services, the scaling should be applied based on the policy set and should be optimized with no of allocated tasks. We have to monitor for the load balancing, the load should be balanced across all the tasks, if a particular task is overloaded the session stickiness and load balancer algorithm needs to be tuned.

Monitoring

Metrics that needs to be monitored as part of Cloud performance Testing, service level CPU utilization, Memory utilization, Instant count, Database reader/writer stats, Cache utilization and expiration.

Moving healthcare into the cloud offers several significant benefits:

1. **Improved Patient/providers Outcomes:** Cloud computing enables faster access to patient data, claim processing, better care coordination, and data-driven insights, leading to enhanced decision-making and improved patient outcomes [1].
2. **Operational Efficiency:** Automating administrative tasks like scheduling and billing helps healthcare organizations run more efficiently, reducing costs and allowing staff to focus more on patient care
3. **Enhanced Collaboration:** Cloud platforms facilitate easy information sharing among physicians, specialists, and healthcare teams, which is essential for integrated patient care.

4. **Scalability and Flexibility:** The cloud provides scalable resources that can be adjusted based on demand, offering flexibility to healthcare organizations to manage their IT infrastructure more effectively
5. **Cost Savings:** By shifting from a capital expenditure model to an operational expenditure model, healthcare organizations can better manage their budgets and reduce costs associated with maintaining on-premises infrastructure.
6. **Data Accessibility and Disaster Recovery:** Cloud solutions enhance data accessibility and provide robust disaster recovery options, ensuring that critical patient data is always available and secure.
7. **Innovation and Advanced Capabilities:** The cloud supports the integration of new technologies like artificial intelligence and machine learning, which can be used to analyze large datasets and gain new medical insights.

These benefits make cloud computing a compelling choice for healthcare providers looking to modernize their operations and improve patient care. Are there any specific aspects of cloud computing in healthcare you're particularly interested [2-7].

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