WHITEPAPER

AUTOMATED TESTING OF LAB MANAGEMENT SERVICES ON CLOUD

While cloud computing offers clinical laboratories the advantage of lowers costs of infrastructure and better storage, among others, it also poses challenges of data integrity and security. IP-driven automated testing frameworks such as Indium's iSAFE provide the labs with a quick, accurate and comprehensive assessment of the health and performance of their services on the cloud platform.

1 ON A CLOUD

Cloud computing, referring to delivery of hosted services over the internet, has greatly facilitated organisations to consume compute power on demand, like electricity, thereby enabling them to focus their investments and resources on their core business rather than on IT infrastructure. Cloud can be deployed on private, public or hybrid models, and accessed as Infrastructure as a Service (IaaS), Software as a Service (SaaS) or Platform as a Service (PaaS).

Cloud technology, primarily consisting of virtual machine (VMs), storage and applications accessed through the Internet, provides organisations with benefit on several counts:

Self-service provisioning: Compute resources for almost any type of workload can be accessed on demand. This eliminates the traditional need for a dedicated IT team to manage compute resources.

Cost reduction: Organisations need not invest in expensive infrastructure or IT resources, using it better to improve their core business.
Elasticity: They can scale up or scale down infrastructure based on the demand.

Pay per use: They pay only for the resources and workloads they use.

Backup & Recovery: Most cloud service providers have backup and recovery solutions, making it easier than when companies have to invest in their own recovery solutions

*Software Integration: I*n the cloud, software integration and customization with great ease, and many a times, automatically.

Information at Fingertips: Accessing information from anywhere, any time, becomes easier when your organisation is on the cloud.

Time effective: Key to adopting cloud today is the advantage of quick deployment that it offers. Considering the pace at which new products are released and updated, cloud can ensure that you are functional within minutes.

2 CLOUD MARKET SIZE

2.1 The Cloud Shift

Given the benefits of cloud, Cloud Security Alliance's finding is hardly surprising –33 per cent of organizations are eager to and 86 per cent spend at least part of their IT budget on cloud services. Nearly 79 per cent of companies get requests from end users periodically each to expand their cloud investments. File sharing and collaboration, communication, social media, and content sharing are some of the most common reasons for requesting cloud services.

According to a Gartner study, by 2020 "Cloud Shift" will affect more than $1 Trillion IT Spending in the next five years, making it one of the most disruptive IT solutions in the digital age.

Forrester research suggests that cloud "middleware", which includes online database management, integration, file management and communications, will touch $14 billion by 2020, up from $4 billion 2016, and will account for 6 per cent of the total.

2.2 Healthcare

Healthcare industry is one of the early adopters of cloud and is expected to be worth $9.48 billion by 2020, up from $3.73 billion in 2015, growing at a CAGR of 20.5 per cent, according to a Markets and Markets report.

A Global News Wire report suggests that Healthcare cloud computing market will be worth $6.8 billion by 2018, with private cloud likely to contribute to highest.

2.3 Lab Information Systems

The laboratory information system in the healthcare industry is a critical component and its market revenue is expected to increase at a CAGR of 9.0 per cent between 2015 and 2025, when it will touch US$ 2,745.3 million.

A Grand View Research study values this segment to touch $ 3.83 billion by 2025, up from $ 2.15 billion in 2015.

Another study by Markets and Markets indicates that the laboratory information market will reach $ 901.6 Million by 2021, growing from $ 634.0 Million in 2016, at a CAGR of 7.3 per cent.

2.4 Growth Factors

Some of the key reasons for the growth of the LIMS (Lab Information Management Systems) have been the improved per capita healthcare expenditure across developed and developing countries. This has led to better quality of patient care and treatment options, supported by information technology solutions that facilitate process-oriented approach to healthcare operations and maintenance of information.

Regulatory harmonization and formation of structured risk-based regulatory framework for healthcare IT initiatives is expected to further encourage secure exchange of data between clinicians and systems while ensuring patient data security and cost-efficient workflow management systems.

3 THE CLOUD FACTOR

3.1 Cloud in Healthcare

The healthcare industry is undergoing a transformation. On the one hand, better medical technology has improved the understanding about health issues. Treatment options have grown by leaps and bounds. Non-intrusive methods are becoming popular. Collection of patient data, interlinking of records and interfacing between different systems for documenting medical history enable accurate treatment.

On the other hand, patients are better informed and demand a right to know. Wearable technology has also enabled them to remain connected to their physicians, and constant monitoring and timely delivery of healthcare solutions has become a reality.

At the heart of this transformation is cloud, which facilitates better collaborations between the various stakeholders at lower costs of investments. Healthcare industry's shift to an information-centric care delivery model is enabled in part by open standards that facilitate better collaboration and information sharing.

Cloud computing provides the various stakeholders such as hospitals, insurance companies, diagnostics to:

- leverage better computing capabilities at lower costs
- focus on innovation due to lower technology barriers
- collaborate better due to improved information sharing, knowledge management and predictive analytics
- manage digital data effectively

3.2 Diagnostics Management

Clinical Laboratory Services Market size is expected to grow at a CAGR of 6.4 per cent from $196.9 billion in 2015 to 2024 and contributes around 80 per cent to healthcare diagnostics industry, according to Global Markets Insights research.

Apart from diagnostics in the hospital, the healthcare industry has several leading diagnostic chains as well as small players. The larger players have their own centres in different parts of the country, as well as manage the centres in the hospitals.

To manage the chains better, nearly 30 per cent of the laboratories in developed countries such as North America, Europe and Japan have opted for laboratory automation and technologically advanced processes for data management to facilitate rapid and seamless operations for greater efficiency and accuracy of clinical processes and results.

Some of the key trends in Diagnostics segment are:
- Home collection of samples

- Outreach programs in remote locations and rural areas for servicing them better

- Centralised diagnostic services

- Need for better logistics and information management systems

- Dissemination of results on multiple media – on the mobile, by email, etc.

- Interfacing with the physician to help provide treatment remotely

Being on cloud helps the labs leverage its speed and scalability for faster delivery cycles.

But, it is not without its challenges.

4 CLOUD CHALLENGES

Being in a public or hybrid cloud and interfacing with multiple systems raise certain concerns:
1. Data integrity and prevention of data loss
2. Security of sensitive data
3. Timely availability of patient health data
4. Timely synchronization of patient health data

Some of the causes for these concerns include:

- Network availability
- Conformance to security requirements
- Proper implementation of regulatory, compliance and internal security and privacy controls

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Test Automation

5 TESTING FOR CLOUD APPLICATION

For the diagnostic services to function effectively on cloud, it is important to test before release as well as for updates.

5.1 Cloud Testing Strategy

The Cloud Testing Strategy will depend on three factors:
1. Whether it is tested at the time of migrating into the cloud
2. Whether it is already installed in cloud and
3. Whether it is built on the cloud itself

Once that has been established, the next stage is to take account of the components:
- the virtualized infrastructure
- network
- application business logic
- end-user experience
- data security and integrity

Applications needing testing include business workflow testing, exceptions mechanisms, simulating failure scenarios and disaster recovery scenarios. In case of enterprise application integration on cloud, then testing would include comprehensive integration testing, API testing and billing mechanism testing.

Moreover, web services automation, capacity testing, release management, integration of the solution on/off premise systems also become critical and need to be tested extensively for the laboratory management service on cloud to function efficiently.

5.2 Comprehensive Testing

An ideal cloud testing partner will test the cloud deployment comprehensively in the following areas:

5.2.1 Functional testing *in Cloud*
These would include:
- System Verification Testing to ensure modules function correctly and interact as expected with one another.
- Acceptance Testing to ensure it meets user expectations.
- Interoperability Testing to not only check its functioning smoothly on all platforms, but also so that it moves from cloud infrastructure to another smoothly.
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5.2.2 Performance Testing *in Cloud*
Apart from functionality, the cloud-based solution needs to be tested
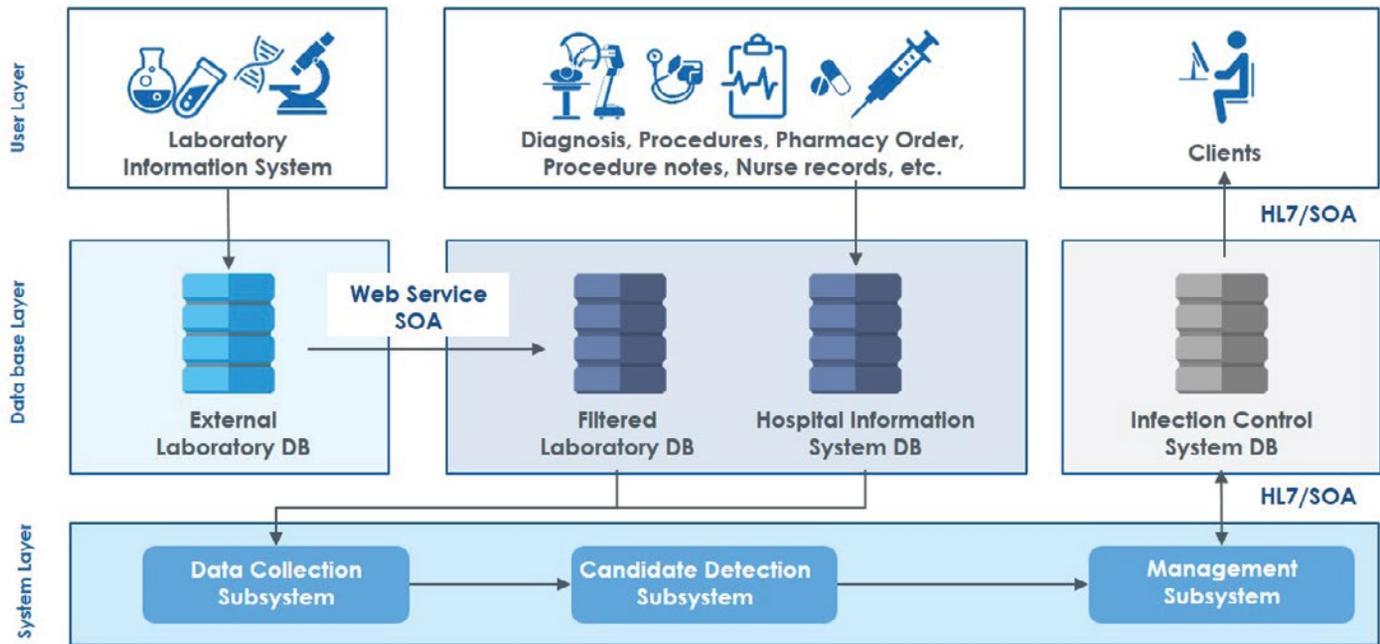
for performance. This includes:

- Response time regardless of the number requests to the system at any given time
- Latency testing
- Workload balancing and stress testing regardless of increase/decrease in load and stress

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5.2.3 Security Testing in Cloud

The data being received and stored is sensitive and needs to be protected from unauthorized access. It also talks to other systems – like in the case of managed services between the hospital's systems and that of the lab service provider. Sharing only the right information relevant to the hospital protecting data collected from other locations is essential. Also, the hospital system may be open to breaches. So ensuring the lab's system is protected despite that would be essential.

5.2.4 Others

- *Disaster Recovery Testing* to ensure the services are available at all times, regardless of failures such as network outages, breakdown due to extreme load, system failures, among others. This should also include measuring the speed at which alerts are generated in case of failure and data loss during this period.
- *Scalability Testing* to make sure that resources can scale up or scale down based on demand.

5.3 Automated Testing

An IP driven test automation framework such as Indium's iSAFE helps shorten the test cycle and go to market quickly. With this:

- Repetitive tasks can be automated, thus speeding up the testing process
- Automate alert generation, to do away with the need for manual monitoring in case of any bugs
- Communication using multiple platforms with detailed report to help the developer identify the problem and remedy it quickly

6 CONCLUSION

Clinical laboratory industry is undergoing tremendous changes triggered by the digital revolution, and especially as cloud provides access to the best of technologies at affordable costs. But it comes with its own challenges. Automated testing enables identifying and fixing any hurdles to smooth functioning of the apps that are mission critical, considering the personal medical data and history they carry of the patients. This needs data integrity and security, two other factors that are vulnerable on the cloud and need to be part of a comprehensive testing strategy.

A test automation framework provides a fast, reliable and robust QA testing solution that can be customised to suit the needs of the lab while assuring them of the scalability and security of the cloud.

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