

LIMS - GOING THE CLOUD WAY



Leading IT technological innovations such as Software as a cloud storage and Service (SaaS) have revolutionized the operation of modern labs. Biobanks, CROs and research labs are fastmoving towards cloud technology, owing to excessive pressures of meeting deadlines and complexities associated with IT infrastructure and support. Why is cloud becoming the best choice for every lab, planning a LIMS implementation? This white paper is for those biobanks, clinical research and food & beverage testing labs which are incognizant of the benefits of cloud computing for managing laboratory operations.

With a constantly transforming global economy, every laboratory urges to evolve and innovate. Laboratories worldwide, encounter a challenge for automating workflows by utilizing minimal resources. They streamline daily operations, often on a shoestring budget. A significant share from the sanctioned grants drifts towards lab inventory such as reagents, consumables, instruments and software. Furthermore, laboratories are required to follow strict regulatory guidelines to meet industry-specific compliance.

LIMS AND ITS BENEFITS

LIMS, an acronym for Laboratory Information Management System, is a sophisticated software system developed to support laboratory

operations. It helps labs manage and track all the biological specimens & workflows, aggregate heterogeneous data for research purposes, and ensures compliance with various standards and regulations.

The main objective of a LIMS is to consolidate the information generated from multiple sources to automate laboratory workflows. LIMS has a compatible interface with all the available instruments, third party software and databases, with which it retrieves the most relevant information and presents it to the user. LIMS promotes the efficient management of sample data, facilitates regulatory compliance and enhances scientific collaboration amongst multiple labs. Be it manual data entries for incoming samples, creating reports, going up to a freezer for picking a sample or locating its whereabouts, labs can save several manhours and spend time on where it matters the most. By implementing a LIMS to automate all these processes, the lab staff can focus on their core research. A LIMS that cannot effectively communicate/ exchange data with other systems within a laboratory/organization can cripple the daily operations. This leads to erroneous data and mishandling of precious biological samples. Ultimately, cutting corners for compromised solutions would result in loss of money and valuable time.

LIMS is a great alternative for labs planning to

migrate from paper logbooks and spreadsheets to a more advanced and dedicated software to manage SOPs. Spreadsheets are inexpensive tools that can store and register important information such as gender, age, collection date, etc., relevant to each sample. However, once the database progressively expands, it is quite difficult to run through multiple spreadsheets for retrieving specific information. A relational database, is often the answer for associating individual records relating to pathological and clinical test results. With LIMS, not only can samples be logged in faster, but the system also maintains the chain of custody and a full audit trail. LIMS safeguards medical information, allows association of test results, alerts pending tasks, work-lists, and also generates reports.

With fast-paced evolution of science, real-time accessibility to information necessitates a dedicated LIMS solution. Labs that deliver quality information to their clients competitively, emerge as leaders. A successfully implemented LIMS increases lab's productivity, improves data accuracy by avoiding redundancy, and proliferates the overall effectiveness. A LIMS can organize all the information pertinent to a laboratory and allows rapid data retrieval and reporting. It also allows sharing of data with other lab members, thereby promoting collaboration amongst multiple labs, separated by geographical barriers. With the latest advancements in cloud computing such as the

SaaS model, time has never been more favourable as much for the small & medium sized biobanks and laboratories. The depreciated instrument and software prices along with growing acceptance of the internet in the present times, has triggered investments in a cost-effective LIMS solution.

CONCEPT OF CLOUD COMPUTING

Cloud computing is revolutionizing many application areas by offering significant benefits such as easy deployment, connectivity, automation and scalability. It is extensively being used as a means of software delivery. Cloud is nothing but a virtual space that enables users across the globe to store and access shared pool of data, resources and programs on demand, which are otherwise stored on a computer hard drive. Cloud uses a network layered approach to connect user's computer to resources centralized in a data centre.

Cloud services can be private (an entire server is dedicated to one client and it can be hosted locally or by a third party), public (a third-party provider delivers the cloud service over the internet) or hybrid (combination of both, public cloud and on-premise private cloud services). Software vendors offering LIMS solutions, especially prefer public cloud model, where the customers pay only for CPU cycles, storage or the bandwidth they consume. Some of the

leading public cloud providers who allow hosting web-based LIMS or other applications are Amazon Web Services (AWS), Google Compute Engine, Microsoft Azure and IBM/SoftLayer.

With fundamental differences, cloud services are further classified into core categories namely, Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). In plain terms, Infrastructure as a Service (IaaS) helps accessing, monitoring, and managing remote data centre infrastructure such as virtual machines, processing, storage, networks and database services. These computing resources are pulled from several servers and networks that are usually distributed across numerous data centres. The clients are given access to these components to build their own IT platforms. It works best for enterprise customers who face complexities and monetary constraints in managing the underlying hardware. PaaS platforms, on the other hand, are geared towards software development, and they offer developers several advantages. PaaS allows developers to build software applications and frequently change or upgrade operating system features. Enterprises benefit from PaaS because it minimizes the amount of coding required, automates business operations and the applications using PaaS inherit the cloud characteristics such as scalability, high up-time, multi-tenancy and SaaS enablement. The platform works great for someone who is

involved in the process of developing and testing at every stage. PaaS makes the deployment of applications quick, simple, and cost-effective.

For implementing a LIMS in a lab, SaaS works great in every aspect, since it enables you to access lab automation application over the internet, pay only for the customization that your business demands, and upload and share data in a secure manner. Deploying SaaS, often referred to as software-on-demand, is similar to renting a software instead of purchasing one, that is usually heavy on your pocket. Traditional LIMS requires upfront investment in software purchase and product installation. SaaS, on the other hand, reduces the TCO (Total Cost of Ownership). Traditional LIMS license mechanism may limit the access to the devices where it is deployed. Software-as-a-Service users, however, subscribe to the software using the pay-as-you-go model (PAYG), wherein the software can be accessed anytime anywhere, chargeable on a monthly basis. The PAYG model eliminates the capital expense of deploying in-house hardware and software. Applications are purchased and used online, while data files are saved on the cloud, rather on individual computers and data servers.

COUPLE “CLOUD-BASED SAAS” WITH “LIMS” TO BENEFIT IMMENSELY

The foremost concern in procuring hardware or

Traditional (On-site Software Application)	Software as a Service (Hosted)
<ul style="list-style-type: none"> • High Upfront Cost in Purchasing the Product • Advanced Infrastructure and Maintenance Needed • Dedicated IT team required • Long Drawn Deployment • Upfront Purchase Required for Future Needs • Accessible Inside Company Network • Paid & Occasional Upgrade Installations 	<ul style="list-style-type: none"> • Available for an Affordable Monthly Subscription • All that is Needed is an Internet Ready Device • Maintenance & Support Included in Monthly Subscription, Guaranteed Uptime • Quick Deployment, Takes a Couple of Hours • Scale as You Go, Extensible • Accessible Anytime, Anywhere • Free & Ongoing Automatic Upgrades

software to accelerate the research process is the TCO. Unlike traditional LIMS, SaaS substantially saves expenses on maintenance, purchase of infrastructure, technical support, upgrades and payroll. The model is beneficial for labs having a dedicated budget, allocated every fiscal year to support and maintain numerous resources including IT. Thus, there are no initial set-up costs and the LIMS application can be readily accessed using a web browser.

The traditional LIMS model draws money in a sense, that it may have several features and functionalities which are ineffectual from a lab's point of view. Yet, one has to pay the full price for procuring the software and that's not all. The annual maintenance policy that accompanies the purchase, tethers the user to pay additionally for availing upgrades, despite of limited usage. This is a typical problem for majority of labs, dealing

with software vendors. The SaaS model, in contrast, allows you to pay only for what you use. If you used LIMS for a limited period of time, you may pay only for that period and the subscriptions can usually be halted at any point of time.

With ascending number of incoming samples on a day-to-day basis in a laboratory, more data is generated for a LIMS to manage. If a LIMS is hosted locally, the data is susceptible to server crashes and inevitable disasters in the face of natural calamities. Hence, maintaining your data on the cloud, ensures that it is protected from system crashes and environmental catastrophe such as floods, hurricanes and earthquakes. The service providers assure continuous data backups, that are available on mirror servers, installed at different geographic locations. These servers are monitored 24x7x365, and the hosting

centres are responsible for regular upgrades, up-time and security as part of the ongoing subscription fee. Hosted on the cloud, the software can be accessed from anywhere with an internet enabled computer, tablet or a smartphone. OS support and compatibility are never a concern when using a software over the cloud. However, there could be a possible threats to data security. With recent advances in data encryption algorithms, the data transmission has been made safe and secure. Unauthorised data access from cloud by any third party is restricted. Cloud based SaaS offers this flexibility to software vendors and their

clients to scale and rapidly configure LIMS, based on specific needs.

CONCLUSION

The potential of cloud computing is enormous and software vendors have just begun harnessing its power. In unpredictable economic times and with evolving cloud computing technologies, cloud based LIMS guarantees a limitless expansion for lab automation at an affordable price and thus, removes the existing bottlenecks for business growth.