

The LabWare Configure Once – Deploy Anywhere™ LIMS Architecture

How effective software design can leverage evolving technologies to reduce risk and improve ROI.

As the commercial LIMS marketplace evolves and matures, it continually faces the challenge of technology change. Perhaps more than ever before, the pace of innovation and the evolution of technology are placing pressure upon both suppliers and consumers of LIMS software. How suppliers have planned for this challenge, and the manner in which their software's design enables them and their customers to meet it, plays a large role in determining the long-term success of implemented systems and the value they provide.

A key aspect in planning for technology change is establishing a systems framework, or architecture, that effectively insulates the application from the technologies upon which it is deployed. In the commercial LIMS marketplace, software suppliers have approached this issue with varied amounts of success. Nevertheless, it remains one of the single most important contributors to system longevity and overall investment value. Application products that can adapt well to new technology and take advantage of innovation remain vital and useful to the business. They continue to provide value over long periods of time and offer the business an opportunity to leverage technical innovation in a way that adds incrementally greater value. Conversely, products that are unable to adapt eventually become unable to deliver the basic features needed by the customer's business. They become more costly and more difficult to maintain, and they eventually become a compliance risk for regulated businesses.

Configure Once – Deploy Anywhere™ is an innovative approach to effective software design that benefits both the vendor and its customers in many ways, and can be a major factor in mitigating technology risk. As the name implies, it offers opportunities for both efficiency and flexibility, and provides the customer with a means of maximizing the value of its software investment.

The commercial LIMS marketplace is characterized by COTS (commercial off the shelf) solutions. The majority of available LIMS systems offer core functionality and some means of tailoring system behavior as part of the implementation process. It follows that the more closely a product can be adapted to the specific use cases of the customer's business, the more useful the implemented system will be. It also follows that accomplishing this without the need for programming changes to vendor code — that is, through configuration rather than customization — places the customer in the best possible position. Many articles have been written on the benefits of configurable systems over customized ones, and configured systems are also clearly favored by regulatory bodies and within established GxP guidelines. Configured systems are typically implemented in less time, are more effectively supported by the vendor's technical resources, and they may be modified more readily to meet future changes in the customer's business. Configured systems are also able to be validated at less cost, and offer a lower total cost of ownership than customized systems¹.

The most successful systems are those that are characterized *entirely* by configuration. In such systems, virtually all of the functional behavior expressed out of the COTS product is enabled during the implementation process without any changes the vendor's source code. Ideally, all of the customer's investment in this configuration activity will be carried forward over time and through changes in the underlying product or platform technology.

¹ LIMS Configuration vs. Customization; Ways to accomplish customer-specific changes and their accompanying cost-of-ownership implications, V. Kershner, Scientific Computing & Instrumentation LIMS Guide, 2003.

So what exactly is the Configure Once – Deploy Anywhere architecture, and how does it offer the best possible means of preserving the customer's investment in configuration?

Several principles are at the heart of the Configure Once – Deploy Anywhere paradigm. First, is the concept of platform independence. For example, while the use of a relational database in the delivery of a commercial LIMS is essential, the choice of which specific relational database should be of no consequence. Second, is adherence to standards. Standards remain one of the surest ways to promote interoperability in a multi-tiered software product. This has been conclusively demonstrated with software developed for Microsoft Windows, and it is being proven yet again with the evolution of web-based systems. Third, is the notion that *absolutely all* of the functionality delivered by the solution must be derived from the application itself, and that *absolutely all* of the system definition in the form of static data, business rules and even code extensions, if any, must be stored in the database as configuration data. This means, of course, that everything from auditing and version control to security and archiving must be handled inherently within the application rather than relying upon brand-specific features of the underlying technologies. Finally, is the principle that the overall system must follow a multi-layer structure consisting of a database layer, an application layer and a presentation layer. In such a model the presentation layer is strictly a rendering of the user interface, based upon the system's configuration. The distinct layers in this model are completely integrated, yet they can be either co-hosted on a single processor or distributed onto separate computing environments, based upon the needs of the customer.

In summary, the system's overall functionality is:

- Expressed in the user interface,
- Rendered by the presentation layer,
- Defined by the configuration and stored in the database, and
- Executed and managed entirely through the [single] application.

A software solution meeting these design principles satisfies the framework necessary for the Configure Once – Deploy Anywhere architecture, and has the potential to provide its benefits.

With a properly designed LIMS system, nearly all effort during the implementation period should consist of configuration activities. In order for a system to deliver the greatest benefit to the business, this configuration effort should be completely transferable across platforms and deployment technologies. Why? Because it is this *configuration* that represents the business rules, workflows, best practices and standard procedures of the organization. The configuration, and the specific functionality that it provides, is what constitutes the true value of the implemented system. With a Configure Once – Deploy Anywhere architecture, the customer preserves and leverages this valuable asset.

The Configure Once – Deploy Anywhere architecture preserves and leverages value in many ways. One of these is the flexibility that it offers. At the outset of the LIMS project, for example, an implementer can use a single PC running MS Access to do all of the table creation and initial design. Since the Configure Once – Deploy Anywhere™ paradigm makes the configuration completely transferable among database platforms, this configured schema can be easily exported to its target database (e.g. Oracle) as a controlled step in the rollout of the system. Another example of how the architecture provides benefit is in the way it smoothes platform upgrades. Let's take the case of a business that for legacy or other reasons is using Oracle 8i for its production systems. While there may be a plan in place to migrate to Oracle 9i or perhaps even to Oracle 10g, a LIMS system provides the customer with immediate value only if it can operate on the present 8i environment. Not only will a Configure Once – Deploy Anywhere system operate on the 8i platform, but it can also make the move to 9i or 10g when the business is ready, requiring no re-design or other type of unproductive re-configuration effort. The Configure Once – Deploy Anywhere™ architecture makes this entirely practical, therefore improving return on assets. This type of flexibility applied similarly to hardware and operating system platforms. The architecture offers the flexibility to use whatever computing platforms or

combination of platforms are available or supported. In this respect the Configure Once – Deploy Anywhere™ architecture enables the customer to leverage its investment in existing technology, or to apply computing resources that are best suited to the particular situation, knowing that the LIMS software will impose no compatibility constraints or limitations.

The point has been made that the pace of new product innovation, and the evolution of existing technologies has placed pressure on suppliers of commercial LIMS software. As evidence, one need only consider the dramatic changes in the vendor landscape during the past two years, and look at the proliferation of “new and improved” LIMS releases that have been introduced during that time. Even the casual observer can see that much of what has happened is the result of technology pressure. Many vendors have encountered insurmountable hurdles. Unfortunately for consumers, an all too typical vendor response to this pressure is to announce a new product version, or worse, a next generation product. Neither of these alternatives does anything to protect the customer’s existing investment.

Perhaps the best recent example of this phenomenon is seen in the way that web technology has impacted the LIMS market. There is no question that the web offers significant benefits as a delivery vehicle for LIMS, and suppliers have seen a rise in the demand for LIMS applications that offer a web-based user interface. In most cases, the supplier response, in attempting to satisfy this demand, has been either to announce next-generation (i.e. replacement) products based on the web, or a next-version (i.e. major upgrade) of their current products. In the case of the next generation product, the customer’s existing system, and the corresponding investment that they have in it, are effectively abandoned. In the case of the major upgrade, the customer *may* be able to migrate its existing system, but must choose to either completely adopt the new web-based paradigm, or knowingly stay with a soon-to-be-obsolete product. None of these scenarios is particularly attractive to the business. They impose technical constraints, typically require a significant reinvestment of time and money, and are extremely disruptive.

By contrast, the Configure Once – Deploy Anywhere™ paradigm treats a web browser simply as an alternate presentation layer. A web application server simply communicates the information required by the browser to render the application within the GUI. The application layer continues to control, manage and execute based on the existing configuration. Furthermore, in the Configure Once – Deploy Anywhere™ architecture, the business has the option to deploy the browser-based interface on a selective basis. Unlike in the next-generation or next-version scenarios, the customer is not forced to make an all-or-nothing election regarding the web. As an alternate presentation of the existing configuration, the browser based interface is happy to co-exist with rich client or thin client user interfaces, and the customer is therefore free to make deployment decisions based on what makes sense for the business rather than what is mandated by the vendor.

In summary, the Configure Once – Deploy Anywhere™ architecture establishes a new and very sensible standard for systems design in the commercial LIMS marketplace. An already implemented LIMS system represents a substantial investment for any business. Effective software design can protect this investment and can exploit new technology in a selective and controlled way. A Configure Once – Deploy Anywhere™ architecture enables the customer to continually progress with evolving technologies, mitigating risk and improving ROI.