

White Paper

Electronic Laboratory Notebooks: Growing with the Needs

by

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The Electronic Laboratory Notebook (ELN) is now widely accepted as a safe and convenient research documentation tool. This paper describes how organizations with minimum effort can start using a cloud based ELN system and, when the needs grow, seamlessly move to an in-house server solution.

Introduction

ELN as a collaborative tool

While most paper based processes have been replaced recently by electronic counterparts, the bound paper notebook is still predominant in many laboratory environments. There are several reasons for this, but the slow progress is surprising to scientists who have already taken the leap. Once implemented the ELN provides an unparalleled convenience compared to the bound books. Record keeping is quick, with copy and paste from applications and instruments. Sharing of data with colleagues is suddenly possible and all records are legible and easy to find.

Intellectual Property

One of the fundamental worries has been how electronic records would be trusted in patent court proceedings. The perception that electronic records are vulnerable while paper books are safe is deeply rooted. In reality the biggest threat to patent litigation is probably the actual condition of the records. In most companies the status of the paper notebooks is a weak spot, simply because they are seen as private rather than corporate. Unsigned books with loose printouts would be a nightmare during a trial when the company's future is at stake. The signing of ELN records can easily be part of a well defined workflow, creating trustworthy records duly signed and countersigned. Digital signatures are now widely accepted in banking and other areas where authentic records are crucial. Rather than jeopardizing intellectual property, an ELN will help protect this key corporate asset.

The need for gradual implementation

Despite the clear benefits of an ELN for both users and companies, the route to get there may not be trivial. Replacing the paper notebook affects the scientist's daily work directly. Such projects must not fail! Unfortunately many scientists have had bad experiences from earlier IT projects which may have looked good from a corporate perspective, but were disasters for the users.

Another hurdle may be lack of internal IT support, in particular for smaller organizations. The perception that computerized tools require a dedicated IT support group has been true in the past, but is changing quite rapidly with new services and technology.

Hence, a gradual roll-out of an ELN with a low entry threshold could increase trust and convince users that the system actually works in reality, and without involving large overhead costs for internal computer systems.

Small scale solution

Software as a Service

Over the last few years the concept of "Software as a Service" or "Cloud Solutions" has exploded. Services such as Google Documents or e-rooms like ProjectPlace give users access to central repositories for documents and data outside of the company's realm. Third party providers have become a competitive and trusted alternative to in-house systems. Using exactly the same principles the iLabber electronic laboratory notebook is a client which can connect people through the internet without any server installation. This Cloud ELN has reduced the technical barriers for getting started with an ELN to a minimum.

iLabber - ELN implemented in 10 minutes

For smaller organizations - typically 5-25 scientists - iLabber is probably the ultimate solution. The training required is minimal and installation takes a few minutes. One user acts as an administrator and invites others to share a workspace and join projects. The final records can be downloaded as pdf files or printed out for long term archiving.

All records are electronically signed and countersigned ensuring that nothing can be changed. In fact, the "cloud" solution could be regarded as safer than those running on in-house servers since the service provider is completely independent from the author's organization.

Since no IT infrastructure is needed except for internet connected PCs the overhead cost is minimal, very much like web-based E-mail systems now common in small organizations.

A changing informatics environment

Reasons for growth

As organizations change, the support systems usually need to be adapted as well. While an externally hosted service is perfect for smaller groups, an expanding organization may want to bring servers in-house when the IT infrastructure gets more mature. There are some other reasons:

- Closer integration with other systems. References to e.g. test sets created by instruments, items in inventory systems or documents can be elegantly done

via drop-down lists in ELN. The ELN system simply connects to other data sources and verifies the existence and optionally retrieves data to be inserted into the lab notebook.

- An extended set of metadata will give richer annotations of the experimental records. Records can be searched based on classifications like scientific discipline, protein target or reaction type.
- Improved electronic record keeping standards may require moving notebook records to a long term storage location and/or backup copies on e.g. microfilm.

ConturELN is the server based equivalent of iLabber. It uses the same client but since the database resides at the customer's server integration with other systems can easily be made, and a richer set of metadata defined.

Transition to an in-house server solution

Moving from the externally hosted "Online ELN" service to the in-house system is straightforward. Once the server infrastructure is in place the export of the iLabber records followed by import into an empty ConturELN installation takes a matter of hours rather than days.

Server environment

The server environment needed is standard, with a Windows application server, typically virtualized, and a database server running Oracle or SQLserver. None of these components are particularly expensive. A RAIDed 500Gb disk will provide sufficient ELN storage capacity for a medium size biotech for several years.

Metadata

Prior to data transfer the organization must define which metadata should be available for annotating experiments. Usually the set can be quite limited. Lists of instruments, reagents and assay protocols are usually available in some form, either as Excel documents or in database tables. Such data can link directly into ConturELN, creating drop-down lists from which the user can make an appropriate selection. The idea that different systems are connected via metadata rather than through desktop applications makes integration easy and robust.

Other applications

ConturELN has very few dependencies on other applications. Data are usually transferred using the Windows clipboard, so most applications can be used for gathering data into the lab notebook. No hard links into the Microsoft Office suite exist, which means that ConturELN will not collide with other internal IT projects. Several chemical editors, such as ChemDraw and Marvin, are supported. If an Oracle Chemical Cartridge is available, similarity and sub-structure searching may be performed.

Client installation

The ConturELN client is only installed once on the user's PC, and can be distributed by any modern application distribution method. Upon startup ConturELN automatically checks for new upgrades, which makes client administration light.

Transfer of the iLabber data

Once the client and server environments are up and the metadata structure is defined the data are exported from iLabber and imported into the local environment. This process typically takes a few hours.

Maintenance

Managing users and access rights is done through a web interface, very much like the iLabber administration module. However, creating regular backups of the Oracle database must be made by the local IT department.

Conclusions

Electronic laboratory Notebooks provided as Software as a Service has radically facilitated the transition from bound paper books, also for small organizations. The IP protection is radically improved and the user satisfaction is usually overwhelming. Once established ELN is hard to live without, both from a corporate and the user perspective. When the number of users are growing and the connections to other internal systems need to increase a change to an in-house server solution is often preferred. Moving from Contur's iLabber system to ConturELN has proven straightforward and safe, with a minimal impact on the users.