Middleware: What’s the buzz?

By Gregory R. Vail

“Middleware” has certainly become one of the hottest buzzwords in the clinical laboratory industry. One of the problems with buzzwords is that they “appear ubiquitously but their actual meanings often remain unclear.”1 At this time, this is certainly the case with middleware for the clinical laboratory. The common definition of middleware, in any industry, is “software that facilitates the communication between two applications.”2 Although this definition may have fit middleware in our industry at first, it is certainly out of date now.

Another problem with buzzwords is that they are often “a trendy word or phrase that is used more to impress than explain.”3 Unfortunately, there are some in our industry that have done precisely this, simply renaming existing offerings. It is imperative that our industry define middleware, or rename it, before its significant benefits are lost in the buzzword world. In order to define middleware, we need to first understand why it came about and what it does.

The business of running a hospital laboratory

Laboratories have undergone some relatively rapid changes in short order. Once profit centers, reimbursement caps, budget cuts, and staff shortages have squeezed them over the past several years. Forced to reinvent themselves, laboratories turned to automation and outreach programs, all while trying to handle more and increasingly complex data.

Many of the early total laboratory automation or TLA systems came with a laboratory automation system or LAS, which determined the routing of specimens within the automation line. Since then, task-targeted automation and work-cell solutions have also become popular, each with its own controlling software. In addition to performing repetitive tasks, all of these systems were geared to automate the workflow within a specific section of the lab. Today’s more robust middleware solutions not only manage the workflow for specific lab sections but also for the lab as a whole and, therefore, can be seen as a successor to the earlier automation applications.

The manufacturing model

Middleware is a critical tool in the popular business model being used lately by clinical labs: manufacturing. One of the bigger gains in efficiency can be realized by having staff process exceptions rather than monitor normal activity — for example, the autoverification of patient results. Middleware has become a key component in supporting this concept, typically through very flexible user-defined rules. Notification of exceptions can also be very flexible, including pop-up windows, text messages, and the illumination of light poles. Other exception examples include the monitoring of instruments, of pending needs for reagents, or of due dates for scheduled maintenance.

Because some of the data currently being produced from newer laboratory testing methodologies (i.e., omics or molecular, including images) is more abundant and more complex, older LISs often cannot properly handle it. Newer middleware systems not only can process this data but also can offer a great deal of flexibility in filtering, sorting, and displaying all kinds of data. Through the use of middleware solutions, efficiency gains are not limited to the processing of data from interfaced devices or systems; in fact, some middleware modules do not even require interfacing. Sample storage and retrieval — otherwise known as sample archiving — is an often overlooked area that takes up much valuable lab-staff time. Included in comprehensive middleware solutions are applications that streamline sample archiving as well as scheduling, performing, troubleshooting, and recording maintenance.
Outreach samples may or may not be bar-coded. Not only is accessioning these samples in the laboratory information system (LIS) and relabeling them time-consuming but also introduces the possibility for human error. (There is a debate as to whether or not outreach requests and results really belong in the LIS due to HIPPA-related issues). Middleware can automatically print barcodes for those tubes that arrive unlabeled as it receives requests from the outreach applications.

The more complete middleware solutions have the ability to simultaneously interface to the LIS, outreach applications, and the lab instruments; hence, outreach samples are already known to the middleware and can be put directly on automation or instrumentation. Results received by middleware from the instruments are directed back to the LIS or the appropriate outreach application.

**Fueling middleware’s growing popularity**

The direct response to laboratories’ requests for solutions to specific challenges has resulted in the emergence of middleware. Several factors are fueling its increasing popularity.

- Updating an LIS, or switching LISs altogether, can cost hundreds of thousands of dollars and take months or years to implement. A middleware installation augments a laboratory’s existing LIS so that it can provide functionality for many additional years — and middleware costs in the tens of thousands of dollars and is implemented in a matter of only days or weeks.

- Hospital labs have expressed a desire to control their own systems. Good middleware puts that system control into the hands of lab personnel, incorporating configuration procedures that require no IT skill, especially that of writing code or pseudo-code.

- Middleware is customarily built in modular fashion, allowing a lab to purchase and employ only those features desired; configurations can be changed or additional functionality introduced at a comfortable pace for the lab, resulting in a system customized to any lab’s particular needs.

Middleware for the clinical laboratory not only interfaces but also provides a plethora of efficiency-enhancing options that allow a lab to conduct business to meet today’s challenges, at a low total cost and with in-lab control. Middleware is clearly in the middle of today’s lab operations.

**References**


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